AUG 1 1941

Vol. 48. No. 3. (New Series. Published Bi-Monthly). June, 1941
Established 1902.

Medical Library

# The Journal of Obstetrics and Gynaecology of the British Empire

Directors

T. WATTS EDEN, Esq., M.D., F.R.C.P., F.R.C.O.G. (Chairman).
H. RUSSELL ANDREWS, Esq., M.D., F.R.C.P., M.M.S.A. (Hon.), F.R.C.O.G.
D. DOUGAL, Esq., M.C., T.D., M.D., F.R.C.O.G.
Sir EWEN JOHN MACLEAN, M.D., F.R.C.P., F.R.C.O.G.
J. YOUNG, Esq., D.S.O., M.D., F.R.C.S., F.R.C.O.G.
EARDLEY L. HOLLAND, Esq., M.D., B.S., F.R.C.P., F.R.C.S., F.R.C.O.G.
MILES H. PHILLIPS, Esq., M.B., B.S., F.R.C.S., F.R.C.O.G.

Editor

SIR COMYNS BERKELEY, M.D., M.C., F.R.C.P., F.R.C.S., M.M.S.A. (Hon.), F.R.C.O.G.

*Director of the Review of Current Literature*

FREDERICK ROQUES, M.D., M.Ch., F.R.C.S., F.R.C.O.G.

CONTENTS

PAGE

NAGUIB PASHA MAHFOUZ, M.Ch. (Cairo), F.R.C.P. (Lond.), F.R.C.O.G., Fellow of Academy of Medicine of New York, and IBRAHIM MAGDI, M.B., B.Ch. (Cairo), F.R.C.S. (Eng.), L.R.C.P., D.T.M. & H. (Lond.), D.R.C.O.G. "Fibroid Tumours of the Uterus." ... ... 293

H. R. GRIFFITH, B.A., M.D., C.M., F.A.S.A., and J. R. GOODALL, *O.B.E.*, B.A., M.D., C.M., D.Sc., F.I.C.S. (Hon.), F.R.C.O.G. "Analgesia and Anaesthesia in Obstetrics." ... ... ... ... 323

T. F. TODD, M.S. (Lond.), F.R.C.S. (Eng.), M.R.C.O.G. "Urological Complications of Carcinoma of the Cervix Uteri." ... ... ... 334

B. H. SHEARES, L.M.S. (Singapore). "The Foetal Abnormalities that Cause Difficult Labour." ... ... ... ... ... ... ... ... 354

J. L. HENDERSON, M.D. (Edin.), F.R.C.P.E. "Hepatic Haemorrhage in Stillborn and Newborn Infants: A Clinical and Pathological Study of Forty-seven Cases." ... ... ... ... ... ... ... ... 377

JOHN ST. GEORGE WILSON, *M.C.*, M.B., Ch.M. (Liverpool), F.R.C.S. (Eng.), F.R.C.O.G. "A Case of Sarcoma of the Femur Complicating Pregnancy." ... ... ... ... ... ... ... ... ... 389

Obituary ... ... ... ... ... ... ... ... ... ... ... ... 392

Royal College of Obstetricians and Gynaecologists: Report of the Tetanus Committee ... ... ... ... ... ... 394

Review of Current Literature ... ... ... ... ... ... ... ... 407

SHERRATT & HUGHES, MANCHESTER.

**Price 10/6 net. :: Annual Subscription, £2 12s. 6d. post free.**
**Colonies and Abroad, £2 15s. 0d. post free. Published Bi-Monthly.**

Entered as Second Class at the New York, U.S.A. Post Office

PRINTED IN GREAT BRITAIN

# The Journal of Obstetrics and Gynæcology of the British Empire Publishing Co. Limited.

*Incorporated under the Companies Acts, 1862 to 1900.*

**CAPITAL, £2,715,**

**Divided into 905 Ordinary Shares of £3 each.**

DIRECTORS

T. WATTS EDEN, Esq., M.D., C.M. (Edin.), F.R.C.P. (Lond.), F.R.C.S. (Edin.), F.R.C.O.G., Stoke Damerel, Thurlstone, S. Devon (*Chairman*).

H. RUSSELL ANDREWS, Esq., M.D. (Lond.), F.R.C.P. (Lond.), Hon. M.M.S.A., F.R.C.O.G., Iford Manor, near Lewes, Sussex.

D. DOUGAL, Esq., *M.C.*, *T.D.*, M.D., Ch.B. (Vict.), F.R.C.O.G., 9 Lorne Street, Chorlton-on-Medlock, Manchester 13.

SIR EWEN J. MACLEAN, M.D., C.M. (Edin.), F.R.C.P. (Lond.), F.A.C.S., F.R.C.O.G., 12 Park Place, Cardiff.

JAMES YOUNG, Esq., *D.S.O.*, M.D., Ch.B. (Edin.), F.R.C.S. (Edin.), F.R.C.O.G., British Postgraduate Medical School, Ducane Rd., Hammersmith, London, W.12.

EARDLEY LANCELOT HOLLAND, Esq., M.D., B.S. (Lond.), F.R.C.P. (Lond.), F.R.C.S. (Eng.), F.R.C.O.G., 97 Harley Street, London, W.1.

MILES HARRIS PHILLIPS, Esq., M.B., B.S. (Lond.), F.R.C.S. (Eng.), F.R.C.O.G., Fernhill, Laugharne, Carmarthenshire.

BANKERS: BARCLAYS BANK LTD., 163 Edgware Road, London, W.1.

SOLICITORS: LAWRANCE, MESSER & CO., 16 Coleman Street, London, E.C.2.

SECRETARY AND OFFICES: E. JONES, 16 Coleman Street, London, E.C.2.

Registered Office: 16 Coleman Street, London, E.C.2.



RADIUM

DOCTORS AND HOSPITALS

*YOU*

can hire up to 100 mgms. of radium for a week, made up to any required specification for

£5 5 0

This includes cost of transit and insurance whilst the radium is in use

J. C. GILBERT, LTD.

COLUMBIA HOUSE, ALDWYCH, W.C.2.

'PHONE: CHANCERY 6060

After 7 p.m. and weekends, MAIDA VALE 4784.

The Journal of
Obstetrics & Gynaecology
of the British Empire

VOL. 48, No. 3 NEW SERIES JUNE, 1941

# Fibroid Tumours of the Uterus

BY

NAGUIB PASHA MAHFOUZ,

M.Ch. (Cairo), F.R.C.P. (Lond.), F.R.C.O.G., Fellow of the Academy of Medicine of New York

*Professor of Obstetrics and Gynaecology, Faculty of Medicine, Cairo; Senior Gynaecologist to the Coptic Hospital, and Consulting Surgeon to the Kitchener Memorial Hospital*

AND

IBRAHIM MAGDI,

M.B., B.Ch. (Cairo), F.R.C.S. (Eng.), L.R.C.P., D.T.M. & H. (Lond.), D.R.C.O.G.

*Assistant Gynaecological Surgeon to Kasr el Aini Hospital, and Gynaecological Surgeon to the Kitchener Memorial Hospital*

WE propose to sketch in this article the history of fibroid tumours of the uterus together with the development of the various medical and surgical procedures employed in their treatment, and to trace the evolution of the operations of myomectomy and hystero-myomectomy, as well as to give a review of 931 cases treated by these operations in our wards.

## PART I. HISTORICAL

Uterine myomata were first described in the 2nd century A.D. by Galen. He gave them the name of scleroma, and defined them as "rather hard tumours arising from any portion of the uterus", and considered them to be due, for the most part, to chronic inflammation.

In the 11th century A.D. Avicenna,[1] the celebrated Arabo-Persian physician, described in his book *Al Kanoon* a variety

of solid tumours of the uterus that can be easily diagnosed by palpation. He stated that these tumours may be confused with phlegmons and cancers of the uterus. Among the symptoms they gave rise to, he mentioned difficulty of urination and defaecation, weakness, loss of weight, and oedema of the feet. The same author also described a variety of solid uterine tumours which bulge out of the cervix and which may grow to such an extent as to fill the vagina and protrude out of the vulva, interfering with coitus. He also states that in certain cases these tumours may take the form of a penis, and be used as such.

Hippocrates and Salius described cases of "uterine stones" delivered from the vaginas of elderly maidens. Evidently these stones were submucous fibroids which underwent calcareous degeneration. The nature of these stones remained a puzzle until Louis presented his *mémoire* to the Royal Academy of Surgery in 1753 in which he described the formation of these stones; but it was Meckel[2] who first found out their true nature. He was followed by Hyenne[3] and Blanc,[4] and by Guibé[5] who published an important work based on 130 cases. In England, Ryan[6] in 1841 gave a detailed description of what he called "calculous productions, or stones" discovered in the substance of the womb and in its cavity. He states that their cause is unknown but that in all probability they are formed in the same manner as biliary and urinary calculi. Ryan also said that it has been stated that they may be felt with the finger, or in some cases with a sound, and said that they produce the same symptoms as prolapsus and polypus, and many other diseases of the uterus, and are rarely detected during life.

The following paragraphs taken from his *Manual of Diseases of Women* sum up what was known about the formation and treatment of these stones up to 1841:

> "Bonet, Skenchius, Lieutuad, Louis, Roux, Amussat and others, have recorded cases of calculi. Some of the stones were analysed; they consisted of a large proportion of animal substance, combining the salts of soda, potash, and lime. Others contained phosphate of lime and gelatine. The size and weight vary, the latter being from 1 to 10 ounces.
>
> "The calculus may be expelled spontaneously according to Louis, or seized with a forceps, the os uteri being enlarged by incision, if necessary, but in one case mentioned in a journal of Turin and cited by the *Rev. Med. T.*, xiv, the os uteri was sufficiently open, the position of the calculus was

changed, and the substance was then extracted by means of the fingers, forceps, and a common spoon.

"When the calculus is too large to pass through the os uteri and is distinctly felt by means of the finger or sound, it might be seized with a curved forceps and broken into fragments of smaller size, which might be readily extracted. If this could not be accomplished with the forceps alone, the percuteur of Baron Heurteloup might be employed, as in lithotripsy, to seize the calculus, and the external extremity struck with a hammer, so as to break up the stone if possible.

"When all these means fail, and the powers of life are endangered, perhaps the stone ought to be extracted through an incision made above the pubis, and through the uterus; an operation which, I apprehend, few would be induced to attempt."

## Terminology

Hippocrates called these tumours uterine stones, and Galen gave them the name of scleroma of the uterus. Hunter employed the term "fleshy tubercle". Ashwell[7] described these tumours as fibrous, cartilaginous, or chondroid, and as scirrhous uterine growths, carcinoma simplex vel fibrosum, or stone cancers. Broca called them hysteromes. According to Graves,[8] Rokitansky coined the name of fibroid and Virchow "Myoma laevicellulare", which was changed later to myoma. In 1813 Bayle described the different locations of these tumours, and stated that in one-fifth of all women after the age of 35 the uterus contains myomata. In 1843 Vogel showed the similarity in composition of myomatous tissue and uterine muscle.

## Treatment by Drugs

The beneficial effect of the prolonged and continuous administration of ergot was first pointed out by Gairdner of Glasgow in 1864 (*Glasgow Medical Journal*, vol. xi), but it was Hildebrand[9] who in 1872 first brought the matter to the notice of the profession and published the method which bears his name and which consists of giving 25 cg. of ergot by intramuscular injections. These injections were given daily and the treatment was continued for several months.

Hildebrand claimed for ergot that it acts in two ways. First, by checking the nutrition of fibroids through diminishing the amount of blood circulating to them, and secondly, by favouring their pedunculation and expulsion. These effects, he said,

resulted from the action of the drug on the unstriped muscular fibre of the walls of the uterus and on the coats of the blood-vessels. In England, A. R. Simpson[10] was a warm apostle of this method. He emphasized the importance of securing a fresh and active preparation of ergot, and laid stress on the importance of the careful choice of cases for treatment.

The formula recommended was the following:

℞

Ergotine, 3ii; Aqua, 3vi; Chloral-hydratis, 3ss M.

The treatment is continued for several months until its effect is seen in diminution of the size of the tumour, or, at least, of the haemorrhage from it. In Simpson's opinion the suitable cases were those in which the tumour was intramural; "it must be surrounded by layers of muscular fibre, sufficiently developed to be capable of being excited to contraction."

Schroeder[11] considered the doses prescribed by Hildebrand and others inefficient, and proved that in most patients treated in this manner the tumours remained stationary. It was only in patients in whom bigger doses are given over very long periods (400 injections) that any appreciable diminution in size is noticed. Churchill and MacClintock[12] favoured treatment by cannabis indica in doses of 10 drops three times daily to stop haemorrhage. They also gave antipyrin for the same purpose. E. Falk[13] was the first to point out the effect of hydrastis canadensis in controlling haemorrhage by causing contraction of the blood-vessels. Schatz[14] spoke highly of this method. He reported a case in which a fibroid which reached the level of the umbilicus was so reduced in size that it became entirely pelvic after 2 years of treatment with hydrastis, hamamelis virginica and viburnum prunifolum. Stypticine was introduced by Zweifel,[15] but failed in the hands of Brietenberg.[16] Jouin claimed good results from thyroid extract. The tumours diminished in size and haemorrhage ceased. The latter, however, pointed out the necessity for caution in regulating the doses. S. J. Simpson recommended bromide of potash which he gave in feeble doses over a long period. Arsenic and phosphorus were also tried by different authors.

Howitz[17] introduced a queer method of treatment which consisted in "systematic suction of the breasts". He claimed that it acted by provoking reflex uterine contractions similar to those produced by ergot.

"Water cures" in sources containing sodium chloride were

for a long time in vogue in France, Germany, and Switzerland. Treatment by hot vaginal douches and by atmocausis was tried by German authors but with little effect.

### Treatment by Electricity

Treatment by electricity was for a long time the method of choice in the treatment of fibroids. The method was introduced by Apostoli, who was inspired by the works of his teacher Tripier.[18] This method was favoured by English and American authors.

Prior to Apostoli, Cliniselli[19] in 1869 published results obtained by introducing two needles in the substance of the tumours across the vagina. He called his method "the electro-chemical method". Cutter in America published his galvanic method in 1871. Aimé Martin[20] and Chéron[21] in France rejected the use of needles, and introduced into the cervix of the uterus a sound joined to the positive pole of the galvanic pile. The electric shock determined by this method was claimed to produce contraction of the fibrous tissues and the walls of the blood-vessels.

Convinced of the danger of galvano-puncture, Apostoli[22] replaced it by what he called "the intra-uterine chemical galvanic method." His method was as follows:

An electrode formed of a platinum sound is pushed into the uterine cavity as far as it can go. The part of the sound that does not penetrate into the uterine cavity is covered by an isolating muff of celluloid or caoutchouc. A special electrode made of glazed earthenware was placed on the abdomen. It disseminated the current over a large area and prevented all chemical reactions. The two electrodes are connected to the two poles of the pile. In patients in whom it was desired to obtain a reduction in the size of the tumour the negative pole was introduced in the uterine cavity.

Apostoli used a current of elevated intensity. He began by 100 milliamperes, but later went up to 200 and even more. The treatment lasted from 3 to 5 months.

In one-third of the patients he treated by this method he claimed considerable reduction in the size of the fibroids. In some cases the tumours were reduced to half their original size. He further claimed that in 95 per cent of the patients he treated complete arrest of haemorrhage and disappearance of signs of compression occurred.

Apostoli's method has been for several years the subject of acute and heated discussion in the different congresses in Europe

and America. In Great Britain the chief advocate of this method was Thomas Keith (*Electricity in the Treatment of Uterine Tumours,* 1889). For several years treatment of fibroids by electricity became the method of choice, but the rapid progress of surgery caused a sharp and rapid decline of the method.

## The Evolution of Operative Treatment

*(a) Polypectomy.*

Avicenna[23] advised excision of all vaginal polypi with or without ligation of the pedicle and the application of measures to stop haemorrhage that might follow. In cases in which the pedicle was thick, he advised applying a tight ligature to the pedicle and leaving the tumour until it necroses and falls out. He might have learnt these methods from the Greeks, or he may have been the originator.

In 1841 Ryan,[24] describing polypectomy, writes as follows:

> "The indication of treatment is to remove the polypus by placing a ligature upon its neck, by incising that part, or by twisting it five or six times with the fingers or a forceps. It has also been torn away, in imitation of its laceration, by the spontaneous efforts of the uterus.
>
> "The effect of the ligature will be to prevent the return of the blood from the polypus, and this part must enlarge, swell, become the seat of mucous or sanguineous discharges, or will speedily separate by sloughing from the womb.
>
> "It may require from three to four weeks before the tumour putrifies or sloughs, more especially when it is fibrous or fleshy. It may also happen that the polypus may become painful soon after the application of the ligature, more especially if it is too tight, and this has been followed by peritonitis, which has proved fatal.
>
> "When the os uteri is rigid, or very much closed, it will retard the descent of the polypus into the vagina; and in such cases it may be rubbed with an ointment of belladonna, as described in p. 207; and should this fail, as it often may, and the distressing symptoms already described continue, the only other remedy, or means of relief, is incision of the uterine orifice."

Ashwell,[25] in 1845, when describing the different methods of treatment of polypi which were in vogue in his time, mentioned

for the first time in English literature that polypectomy was then practised not only for polypi protruding from the cervix but also for intra-uterine tumours. His description runs as follows:

"There can be no doubt of the propriety of the removal of a polypus when within reach, as a spontaneous cure rarely ever occurs, and there are but few instances in which the danger does not progressively increase. I have twice known the peduncle so attenuated by the weight of the bulb that it has broken prior to the operation. In one of the cases I had prepared to tie the polypus in the ward at the hospital, but on introducing my finger I found it detached and brought it away.

"It must not be supposed that it is an easy matter to noose every polypus. The ligature may slip, and it may sometimes be thought that it encircles the stem when it has not passed round it. Any attempt to draw the ligature tight will prove the error; nor in difficult cases will it avail for any good purpose to be in haste or forcibly to attempt the noosing. In this, as in every other operation having to be done out of sight, gentleness, patience, and tact alone can ensure its safe completion. Often when I have been foiled, and the ligature has become moist and slippery, the substitution of a new piece of whipcord has facilitated the tying; nor is change of position an unimportant expedient. The operator must not be deterred from proceeding by haemorrhage; this very bleeding justifies continued efforts.

"Silver wire has been recommended; but Burns says it is apt to twist, or to form little spiral turns, which impede the operation and may eventually cut through the tumour. Silk cord, strong thread, or whipcord may be used; to the latter I give the preference, and now invariably employ it.

"M. Lisfranc says he succeeded in breaking up two intra-uterine polypi by what he terms (*arachement*) avulsion, they having previously become soft and pulpy. In one instance, while attempting to depress a polypus for the purpose of excising it, he heard a sound as if something had given way, and he found the polypus completely detached.

"The same surgeon dwells on 'enucleation' as a frequent means of removal, both for polypi and fibrous tumours whether situated completely within the cavity of the uterus or partially in the vagina (p. 137). In one case he perceived that the envelope of a fibrous polypus, consisting of a thin

layer of the tissue of the uterus, was torn; he passed his index finger through the rent, and enucleated the tumour with the greatest facility. In another instance enucleation was accomplished in a few seconds. In a third example, when a fibrous tumour, as large as the clenched hand, protruded into the vagina, its envelope was lacerated with the finger nails, and the contained tumour at once turned out. From a perusal of M. Lisfranc's essay it is quite clear that polypi still within the uterine cavity are not beyond the reach of his knife. 'We made an attempt' (pp. 242–8), he says, 'to excise an intra-uterine polypus; but the pedicle could not be detached, and a portion of the tumour, estimated at about half its bulk, was cut away; the part left behind, however, sloughed, and the patient perfectly recovered.' These and other processes are propounded by M. Lisfranc, but it is a matter for congratulation that such things do not require to be done in England.

"Polypi may be removed by ligature and by excision. Torsion or twisting off has been practised occasionally, and Siebold has successfully used the actual cautery."

*(b) Surgical Attempts to produce Atrophy of the Tumours.*

Two of the earliest attempts to reduce the size of the tumours and to stop haemorrhage were ligature of the uterine vessels and ovarian castration.

(1) *Ligature of the uterine vessels.* This was first introduced by Hofmeier and Von Antal and advocated by Rydiggier and Martin of Chicago. A certain number of successful cases were reported from time to time, but the method soon fell into disuse.

(2) *Ovarian castration.* In 1876 Trenholme[28] published the first known example of castration for uterine myomata. A few months later Hegar[29] practised the same method. On the 10th July, 1880, Lawson Tait published in the *British Medical Journal* a table of 26 castrations performed for several conditions, including menorrhagia and haemorrhage from myoma. His first operation was performed in 1872. Referring to the question of priority Lawson Tait, in a pamphlet on uterine myomata (1885–90), page 15, says:

"I do not like to see the persistent inclination on the part of some of my metropolitan brethren to give the credit of the introduction of the plan, now universally adopted, of remov-

ing the uterine appendages for the relief of pain and haemorrhage, either to Germany or to the United States, when, as a matter of fact, it was done by myself, after mature deliberation and discussion, some considerable time before it was done either by Professor Hegar or by Dr. Battey. The details have already been published in my book, and I need only briefly refer to the fact that the first discussion and final settlement of the proposal was made in October, 1871, the operation upon that patient being performed successfully on February 11th, 1872. Dr. Hegar's case was performed on July 27th, 1872, with a fatal result. My second case, which was also successful, was performed on August 1st, 1872; and Dr. Battey's, which was also successful, was performed for reflex nervous troubles on the 17th of the same month. The discussion of the principle of the operation was given in full in my Hastings essay on 'Diseases of the Ovaries', published by the British Medical Association in 1873. So long as these facts cannot be contradicted, the whole merit of the thing, however much or little it may be, belongs to British surgery."

*(c) Conservative Operations.*

The idea of enucleation belongs probably to Velpeau;[30] but in all probability it was Lisfranc[31] and Amussat[32] who performed the first operation of this kind. Atlee[33] (1853) and Marion Sims[34] (1874) propagated the operation in America, while in England Baker Brown[35] (1862) and Duncan[36] (1867) published several articles on myomectomy performed *via* the vagina. As a preliminary step they either dilated the cervix by Hegar's bougies or else incised it either bilaterally or by multiple incisions which were carefully sutured at the end of the operation. When enucleation of the tumours was found difficult, the operation was performed at two sittings. At the first, deep incisions were made in the capsule. A few days later, when the uterine contractions have effected a certain amount of separation and expulsion of the tumours, the latter were enucleated (Atlee, Matthews Duncan, Marion Sims).

*Vaginal myomectomy and morcellation.* The credit of this operation is due in great measure to Emmet,[37] who, in 1874, described the technique of the operation. His method was later modified by Czerny.

*Abdominal myomectomy.* The two first abdominal myomectomies were performed by Spencer Wells[38] in 1863. Martin[39] of Berlin (1878) described a special technique which placed the

operation on a sure basis. In Germany, Schroeder,[40] Hegar,[41] Küstner,[42] and Schauta[43] were great supporters of the operation, while in America Kelly,[44] Polk,[45] Noble,[46] and Dudley[47] did much to improve the technique.

(*d*) *The Evolution of Hystero-myomectomy.*

From a historical standpoint the development of hystero-myomectomy is of great interest. We, therefore, propose to give a sketch tracing the various procedures which gradually brought this operation to its present safe and simple technique.

Hystero-myomectomy may rightly be called the daughter of ovariotomy. The earliest attempts were performed by surgeons who mistook these tumours for ovarian cysts. After opening the abdomen and discovering their mistake, they proceeded to do what they could to remove the tumours. Among the earliest pioneers we find the names of Lizars (1825), Dieffenbach (1826) and later Atlee, Baker Brown, and Cutter. In all, 15 operations were published with 5 deaths. Heath[48] in 1843 seems to be the first who deliberately opened the abdomen for a fibroid of the uterus and performed hysterectomy.

In 1843 Charles Clay of Manchester also opened the abdomen for the removal of an ovarian tumour. On finding his mistake he proceeded to remove the tumour, and performed the first recorded hystero-myomectomy. The result was fatal. The first deliberate attempt at removal of a uterine tumour by hysterectomy was made by Bellinger[50] in 1846. He elevated the tumour and divided the lateral ligaments. He then tied the arteries with animal ligatures and cut across the neck of the uterus. The wound was closed by sutures, plasters and bandage. The patient died of peritonitis on the 5th day.

In 1853 Burnham[51] performed the first successful hystero-myomectomy. Two years later G. Kimball[52] performed the first supravaginal hysterectomy *and dropped* the stump. The early surgeons who attempted hysterectomy greatly dreaded bleeding from the cut surface of the stump, as well as sloughing of the latter resulting in fatal peritonitis.

The attempts to deal with both difficulties began with Clay, who performed the first successful supravaginal hysterectomy in Europe on January 2nd, 1863, a few months before Koeberlé[53] of Strasbourg, who performed his operation on April 20th, 1863.

Clay's description of his operation runs as follows:

"I therefore fixed January 2nd, 1863, for this operation, stipulating that after making an exploratory incision I should

be at liberty to forgo the extirpation if any peculiar difficulties presented themselves. I made an incision of about 11 inches, when a large uterine tumour came in view. Though there were no adhesions, it was with the greatest difficulty it could be dislodged from the pelvic cavity. I dissected the broad ligaments from the tumour, and, securing them by ligatures, divided them, and continued my progress down to the cervix. Having satisfied myself by passing my finger well round it, I placed a ligature on it just immediately above the plane of the os, consisting of three strands Indian hemp, and then divided the cervix . . . and the patient placed comfortably in bed in about fifteen minutes from the commencement.

"By the eighteenth day all the ligatures had come away and the patient recovered, and left the hospital thirty-five days after the operation."

He was followed by Koeberlé, who invented the serre-noeud and introduced the extra-peritoneal treatment of the stump. The cervix was dragged into the lower angle of the incision, transfixed with pins, surrounded by the serre-noeud and the tumour and the corpus uteri cut away. The cervical stump was left suspended by the pins, in the lower angle of the wound, so that haemorrhage could be immediately detected and controlled, and sloughs and discharges from the cervical stump could find ready exit.

A new phase of development was the replacement of the serre-noeud by a permanent elastic ligature. This method was conceived by Kleberg[54] of Odessa, who performed his first operation on the 8th July, 1875. In 1878 Martin of Berlin[55] replaced the permanent elastic ligature by a provisional one using Esmarch's principles. In 1880 Dorff,[56] finding that failure of the elastic ligature was due to its slipping, transfixed the pedicle above the ligature by 2 pins and fixed the stump to the lower angle of the abdominal wound. Kocher of Berne[57] modified this method by applying an elastic ligature, below which he transfixed the stump by 2 silk ligatures.

In 1879 Schroeder[58] recommended ligature of the 4 principal arteries and also devised tying the round ligaments. In spite of these precautions slipping of the elastic ligatures often occurred, leading to secondary haemorrhage and peritonitis. In order to evade these complications Schroeder devised the following technique. He tied the ovarian arteries, then the round ligaments, and then the broad ligaments. He then divided the

structures up to each side of the uterus. An elastic band then being placed round the neck of the uterus, the uterine arteries were tied above the elastic ligature and the tumour amputated. The elastic band round the stump was now removed and the stump was covered by peritoneal flaps. This same technique was practised and described by Spencer Wells[59] in 1878.

In 1879 Czerny[60] and in 1882 Olshausen[61] recommended that the elastic ligature should not be removed but should be sutured to the pedicle by silk threads to prevent its slipping.

In 1888 Hofmeier[62] and in 1891 Chrobak[63] published techniques similar in detail to those of Schroeder and Wells.

In spite of these precautions secondary haemorrhage continued to occur. This was found to be due to sloughing of the stump caused by the constricting ligature and also by the cauterization of the stump which was the practice then. In order to remedy these complications two measures were adopted, namely: (*a*) systematic ligation of the ovarian and uterine vessels in their course instead of ligating them with the ligaments; and (*b*) the omission of the cauterization of the stump. The credit for the first step is now given to Stimson[64] of New York, who in 1889 advocated tying the arteries in their course in place of ligation of the entire broad ligament; and the credit of the second is given to Baer.[65] According to MacKay, Milton[66] of Kasr El Aini hospital of Cairo was "one of the first to recognise that the ligation of the vessels was the cardinal preliminary step in hysterectomy."

In 1881 Schroeder[67] attempted the first trustworthy intraperitoneal treatment of the stump. In 1884 Emmet[68] showed that the retroperitoneal treatment was truly an intraperitoneal method, and that it was the safest method of all. His technique was brought to perfection by Goffe[69] and Dudley,[70] who developed the principle of suturing the bladder peritoneum to a posterior peritoneal flap.

In 1826 Howard Kelly[71] introduced several modifications and published the technique which bears his name and which was further simplified and perfected by Pryor[72] in 1896.

The next step was the development of total extirpation of the uterus. The first panhysterectomy was performed by Bardenheuer,[73] who began his operation by separating the cervix from its vaginal insertions *via* the vagina and completed the operation *via* the abdomen. In 1886 Péan[74] practised in France the first total hysterectomy. He began the operation by opening the

abdomen but finished the separation of the pedicle *via* the vagina. In 1890 Martin[75] described a similar method, and in 1896 Doyen[76] published the method that carries his name.

## PART II. REVIEW OF 931 OPERATIONS FOR FIBROIDS OF THE UTERUS

The incidence of fibromyomata of the uterus appears to be as frequent in Egypt as it is in Europe and America. Over 8 per cent of the patients admitted to our wards have uterine fibroids.

We have collected, from our records, a series of 931 consecutive cases of uterine fibroids treated by operation during the last 15 years. The age incidence among our series showed that more than 50 per cent of the patients were between 30 and 40 years old; 25 per cent were between 20 and 30 years; and 20 per cent were between 40 and 50 years. Only 21 women were above the age of 50, and 9 below the age of 20 years. The youngest patient was 12 years of age, and the oldest 65 years. Davis and Cusik[77] also found that their highest age incidence (43.4 per cent) was between 30 and 40 years, but the incidence of 39 per cent between the age of 40 and 50 years is much higher than in our series. It appears that in our country women mature, marry, and bear children at a comparatively earlier age, and the incidence of gynaecological diseases among them is on the whole earlier in its appearance.

The majority of our patients were married women. Fourteen were unmarried and 18 were virgins; 30 per cent were sterile, and 70 per cent had already borne children. The average parity was 2, and 17 per cent gave a history of one or more abortions. From this it appears that fibroids in our series did not appreciably increase the risk of miscarriage, as this figure may be considered a moderate estimate of the risk of miscarriage among all pregnancies.

### Pathology

Among our series of 931 cases 92 per cent of the tumours were multiple and 8 per cent were single. The figures given by Davis and Cusik are 86 per cent and 14 per cent respectively. Beckwith Whitehouse,[78] in Eden and Lockyer's *Gynaecology*, states that not more than 1 or 2 per cent of the tumours are single. In common with the findings of other observers the majority of the tumours, 58 per cent, were intramural; 24 per

cent submucous and 18 per cent subserous. In 3 per cent the tumour grew between the layers of the broad ligament, and in 1 per cent retroperitoneal extensions were encountered. Only 2 per cent of our patients had cervical fibroids. Beckwith Whitehouse puts the percentage of cervical fibroids at 8, while Shaw[79] puts it at 4.

Associated inflammatory lesions of the adnexa were present in 28 per cent of the series, and these, apart from increasing the difficulty of operation, greatly contributed to the mortality. Ovarian cysts were associated in 16 per cent of the patients. Prolapse of the uterus was present in 9 patients, and inversion of the uterus occurred in 2.

Chronic appendicitis was associated in only 2 per cent of the series. We are not in favour of the routine removal of the appendix during abdominal operations, and this low incidence justifies our view.

Acute endometritis was present in 7 patients. Impaction in the pelvis occurred in 2, and axial rotation in 5 patients. The tumours in the latter condition were of the subserous pedunculated type. Fig. 13 is a good example. In this case the pedicle, in spite of its thickness, showed one complete twist. The diagnosis was made after opening the abdomen, as the symptoms were not different from those of a twisted ovarian cyst. Axial rotation of the uterus as a whole occurred in 4 patients without giving rise to acute symptoms. The condition had developed gradually, and was only discovered at laparotomy.

In performing myomectomy we met with a large number of cases in which diffuse hypertrophy of the myometrium existed. Our attitude in most cases was to remove the myomata and leave the myometrium untouched. In 5 cases uteroplasty was performed, a wedge-shaped piece of the hyperplastic myometrium being removed. Involution of the muscle frequently followed myomectomy, but in a certain number of the patients involution did not follow, though the enlarged uterus did not give rise to much discomfort. We have recently modified our technique in cases in which the hypertrophy was very marked by removing a portion of the muscle.

Degeneration occurred in 18 per cent of our cases, and was chiefly of the myomatous type. Fatty, cystic, and calcareous degenerations were noted less frequently. Red degeneration was present in 6 cases. Fig. 5 is that of complete telengiectatic degeneration of an interstitial fibroid which weighed 10 kilograms (22.5 pounds). The patient was 50 years of age and

harboured the tumour for over 15 years. Symptoms of acute abdomen, very similar to those of a ruptured appendicullar abscess, caused the patient to seek surgical treatment.

In 3 of our cases the neoplasms were found detached from the uterus and parasitic on the omentum. One of these tumours was the size of a football, and 2 were of the size of a foetal head at term. In one case we removed a calcareous fibroid as big as a tennis ball, which was lying free in the peritoneal cavity.

Spontaneous enucleation and expulsion occurred in one of our cases. A large sloughing submucous fibroid, weighing 7 pounds, undergoing necrosis, was expelled spontaneously on the eve of the operation from the uterus of a patient who was being prepared for myomectomy. Early next morning the tumour was lying free between the patient's thighs. She made an uninterrupted recovery.

*Malignant Types.*

Among our patients we had 3 examples of malignant metaplasia of which 2 consisted of sarcomatous metaplasia, and one proved to be an endothelioma. (See Fig. 4.) Two of the 3 patients had been treated by vaginal myomectomy, and the tumours were pronounced microscopically to be benign myomata of typical structure. Recurrence of the neoplasms necessitated hysterectomy. In one case sarcomatous metaplasia was present and in the other an endothelioma was discovered. In the third case multiple fibroids of fairly large size were removed by abdominal myomectomy from an unmarried girl 25 years old. Some of the tumours were intraligamentary. One year later the patient came back with extensive recurrences, much larger than the original growth. Malignant metaplasia had supervened.

These transformations, though rare, occur commonly enough to have led several authorities, both ancient and modern, to describe two types of fibroids: one benign and the other malignant. In 1845 Ashwell[80] stated that fibroid tumours belong to the scirrhous variety of carcinoma. He says:

> "It may be advisable to recapitulate some of the numerous synonyms of these tumours. By many authors, the names of fibrous or fleshy tubercle have been used: doubtless, because their texture was, in the specimens examined, softer than usual. By others, they have been denominated, scirrhous uterine growth, carcinoma simplex vel fibrosum, stone cancer. . . . And when their pathology is examined,

satisfactory reasons may, I think, be adduced to show, that by whatever name they are designated, they ought to be regarded as malignant, although occupying the lowest place amongst adventitious heterologue formations."

In another chapter he says:

"No one can deny, that the hard or fibrous tumour is the predominant organic disease of the walls of the uterus; and it must be granted, owing to their simpler structure as compared with the cervix, and the relation which always exists, as to malignancy, between adventitious growths and the texture in which they are produced, that an indolent and benign character generally appertains to this variety. Still there are more points of resemblance to carcinoma than might be supposed; for these growths do occasionally disorganize the structure of the uterus, as may be seen by preparations in our different museums, and they often destroy life (*vide* cases) by that softening, degeneration, and breaking down, which can hardly be called ulceration, but which is peculiar to cancer."

Simpson[81] considered fibroid tumours quite benign, but believed that the irritation caused by their presence may ultimately lead to malignancy. Schlagenhaufer[82] in 1902 published a case in which benign fibromatous metastases were discovered at the autopsy of a patient from whom he removed a fibroid of the size of an egg 15 days previously.

Ulesko-Stronanowa[83] in 1903 published an article in which he affirmed the reality of the malignant types of fibroids. Evans[84] in 1920 stated that: "Various observers have demonstrated the existence of malignant myomata and cellular myomata within the structure of fibromyomata, other portions of which were of the ordinary benign tissue type. Williams[85] in 1894 gave this point careful study. Kelly and Cullen[86] also make it plain that these tumours arise within the structure of fibroids. Present observation lead to the conclusion that this irregular transformation of otherwise benign tumours is not usual, for it was not definitely evident in a large series of cases. Sometimes, at an operation, the malignant types cannot be distinguished from the benign fibromyomata."

Brewer[87] in 1921 reported a case of a large typical fibromyomatous tumour arising in the abdominal wall in the scar of a previous laparotomy performed for the removal of a myomatous uterus 10 years before. The tumour was $16 \times 13 \times 9$ centimetres

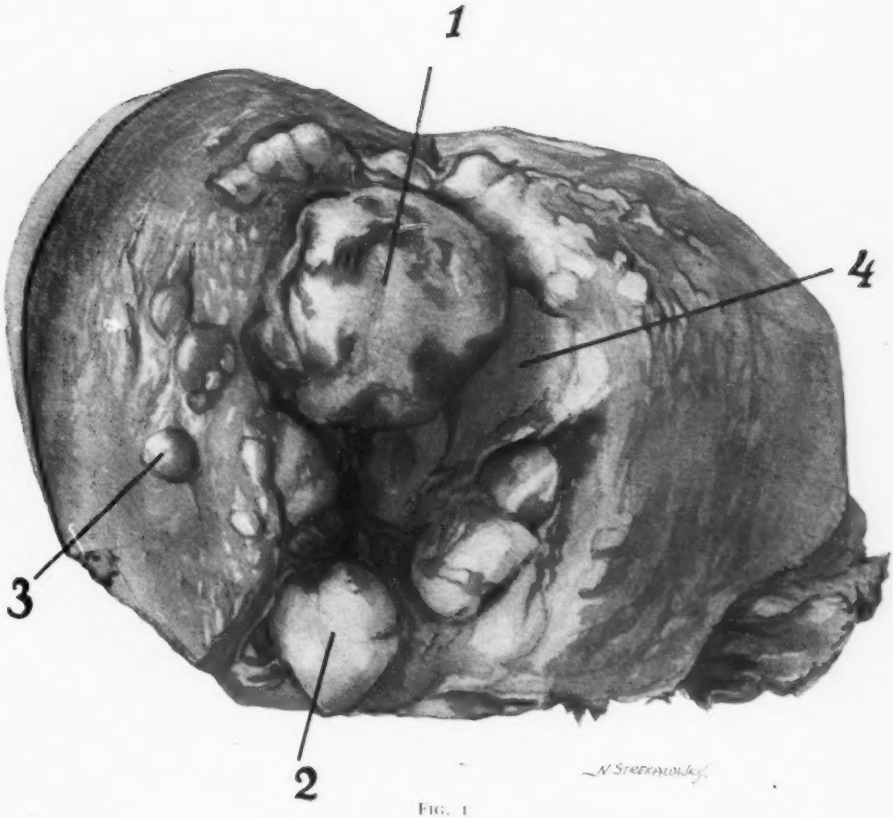



FIG. 1

MULTIPLE MYOMATA

Uterus removed by subtotal hysterectomy. This uterus contains an unusually large number of submucous fibroids, some sessile and some polypoid. Note the faceted appearance of the submucous fibroids.

The specimen was kindly presented for the museum by Professor Shafik Bey.



UNIV. OF MICH.

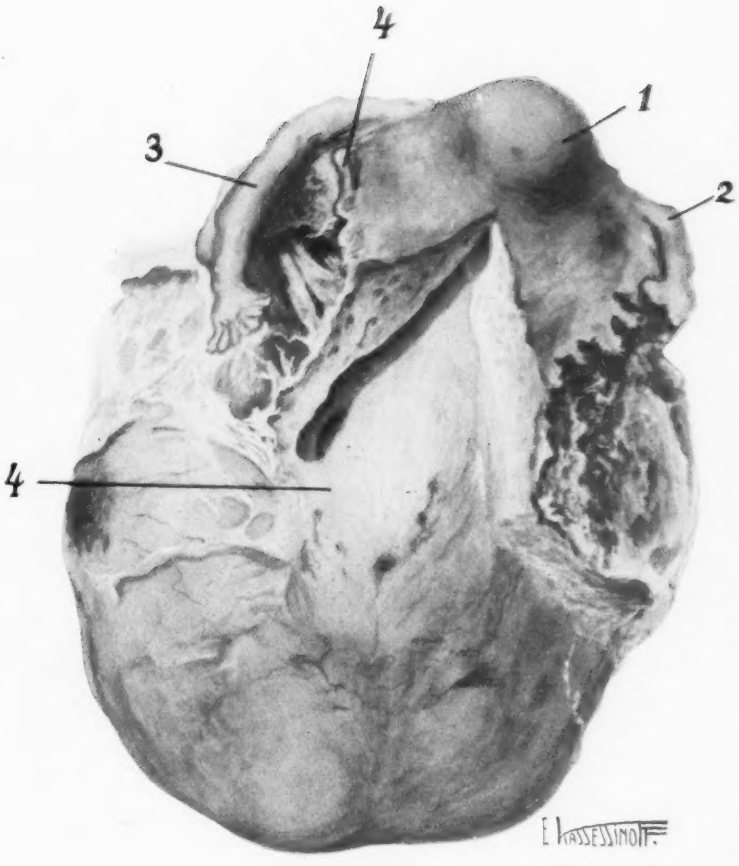



FIG. 2

CERVICAL MYOMA

The tumour has elevated the body of the uterus, so that the corpus uteri rides on the top of the cervical growth which is situated in the posterior wall of the cervix.

1. Small myoma at the fundus of the uterus.
2 & 3. Fallopian tubes. 4. Round ligam.

318. *Mahfouz's Obstetrical and Gynaecological Museum.*

UNIV. OF MICH.

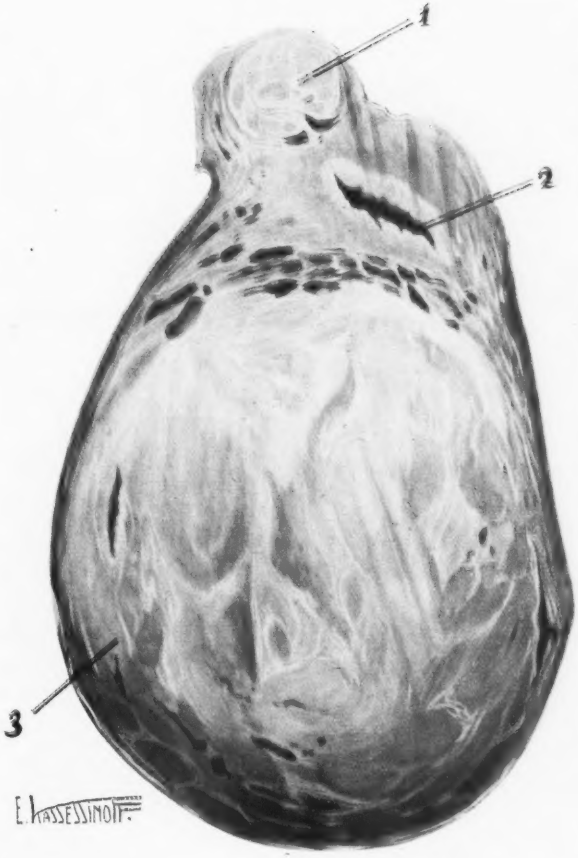



FIG. 3

UTERUS. FIBROMYOMA OF THE FUNDUS.

The specimen is a uterus removed three weeks after confinement by subtotal amputation on account of necrosis of a large fibroid.

340. *Mahfouz's Obstetrical and Gynaecological Museum.*

UNIV. OF MICH.

FIG. 4

UTERUS. ENDOTHELIOMA OF THE BODY

Vaginal myomectomy was done six months previously. The tumour was examined and reported to be a degenerated myoma. Three months later haemorrhage recurred and persisted. Total hysterectomy was performed. The uterus has been bisected to expose the growth which was invading the uterine wall and projecting into the uterine cavity. The lower pole projects into the cervical cavity. Microscopically the tumour proved to be an endothelioma.

417. *Mahfouz's Obstetrical and Gynaecological Museum.*

UNIV. OF MICH.

FIG. 5

MYOMA OF UTERUS. CAVERNOUS HAEMANGIOMA

The specimen shows a uterine myoma that has undergone telengiectasis. This is the only case in our experience of a true angiomyoma in which the tumour became wholly degenerated. The patient was a multipara 56 years old. She had been suffering from metrorrhagia for the last ten years. Three years before admission to hospital bleeding ceased completely and the tumour which filled the abdomen began to decrease in size. Three weeks before the operation was performed signs of acute abdomen brought the patient for treatment. Malignant degeneration of a pre-existing fibroid was diagnosed.

After removal the tumour was carefully examined by Professor Sorour Bey, who reported the tumour to be a cavernous haemangioma, being composed entirely of blood vessels.



UNIV. OF MICH.

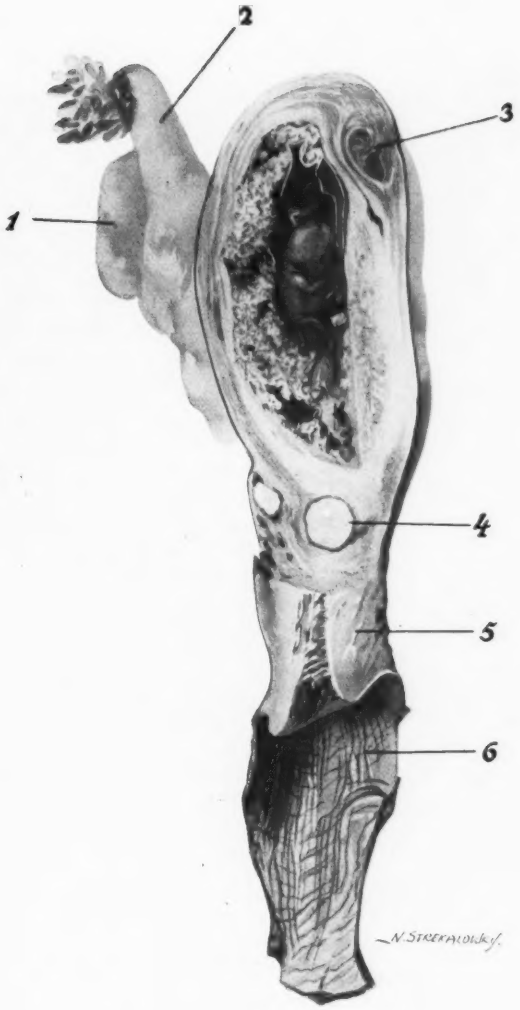



FIG. 6

PREGNANCY IN A MYOMATOUS UTERUS

Uterus and vagina removed post-mortem from a patient who died as a result of heart failure.

1. Ovary.
2. Fallopian tube.
3. Myoma near fundus.
4. Myoma near cervix.
5. Cervix.
6. Vagina.



UNIV. OF MICH.

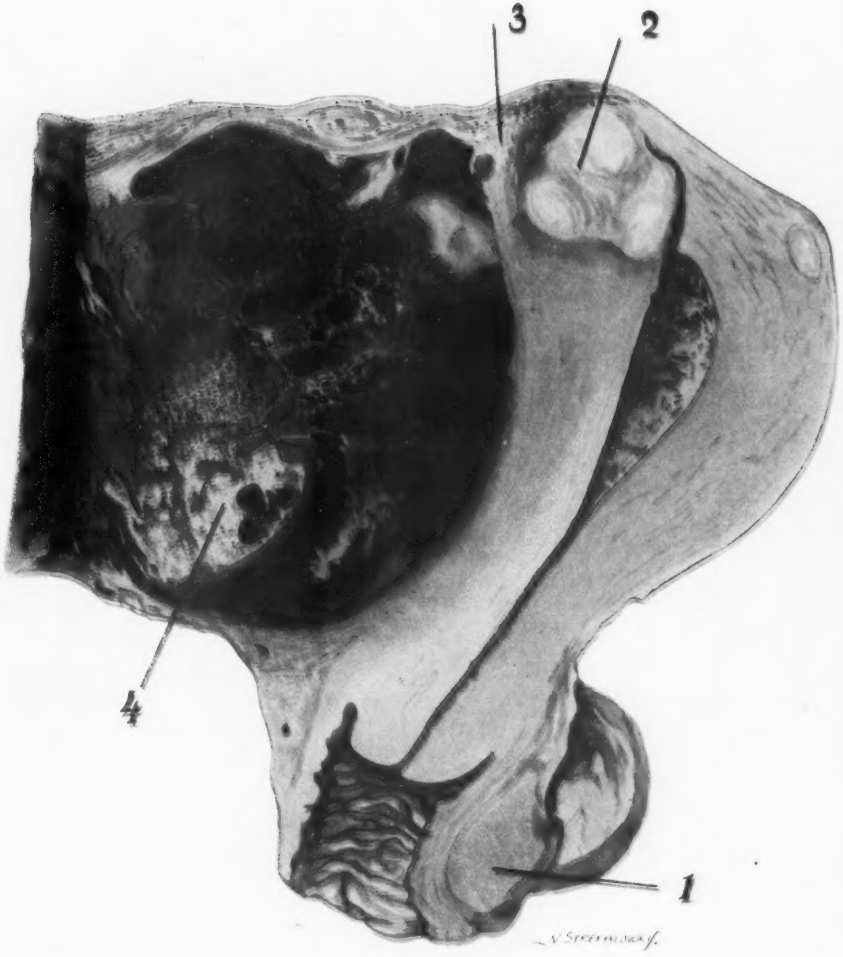



FIG. 7

Fig. 7 represents the posterior aspect of the left half of Fig. 8. 1. Myoma at vault of vagina (anterior wall). 2 & 3. Myomata at the uterine cornua of the uterus which compressed the interstitial portion of the left tube and were probably the cause of ectopic pregnancy.

[O1B(2). *Mahfouz's Obstetrical and Gynaecological Museum.*

UNIV. OF MICH.

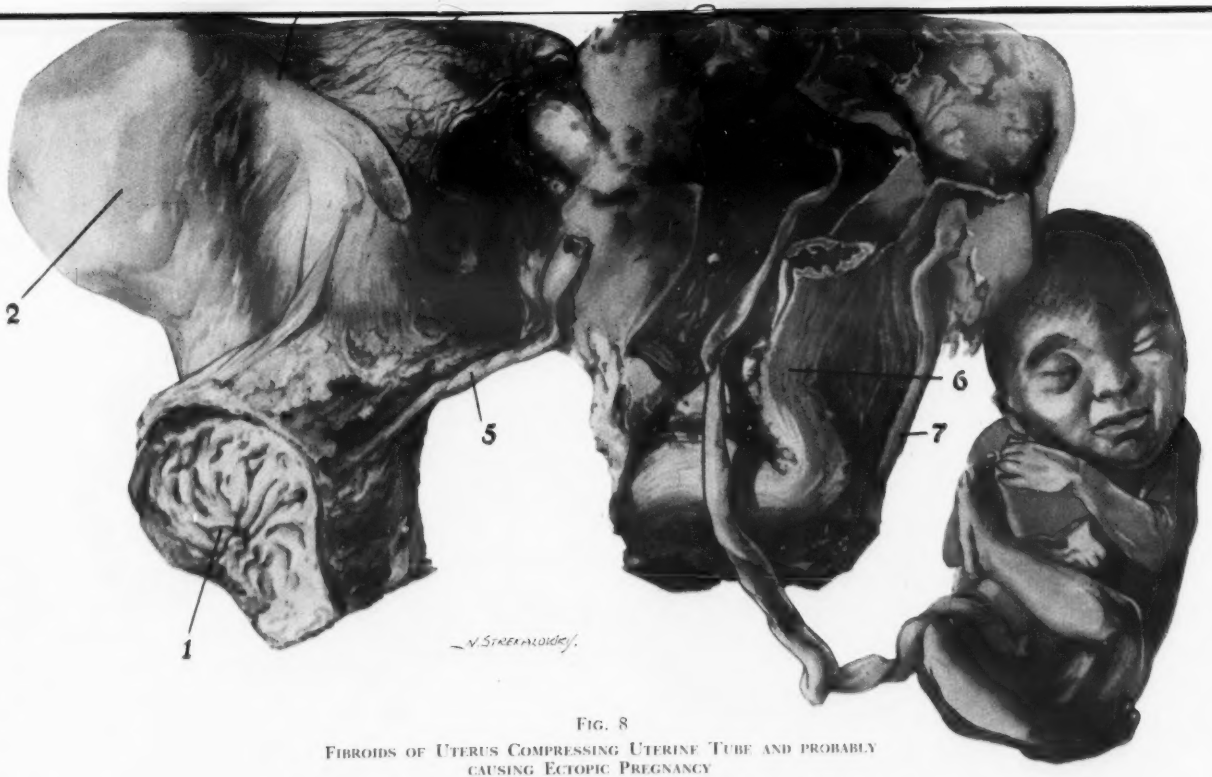



FIG. 8

FIBROIDS OF UTERUS COMPRESSING UTERINE TUBE AND PROBABLY CAUSING ECTOPIC PREGNANCY

SECONDARY RUPTURE OF AN INTRALIGAMENTOUS FIVE MONTHS' FOETATION

The specimen was removed post-mortem from the body of a patient who died from intraperitoneal bleeding, the result of rupture of an intraligamentous ectopic pregnancy.

Anterior aspect of a bisected uterus. The left side of the drawing shows the anterior surface of the uterus.

1. Bladder. 2. Ant. surface of the uterus. 3. Round ligament.
4. Broad ligament. 5. Ureter.

(In the right half of the drawing is shown a ruptured five months' intraligamentous pregnancy.)

6. Rectum. 7. Right ureter.

404B(1). *Mahfouz's Obstetrical and Gynaecological Museum.*

MICH. UNIV.

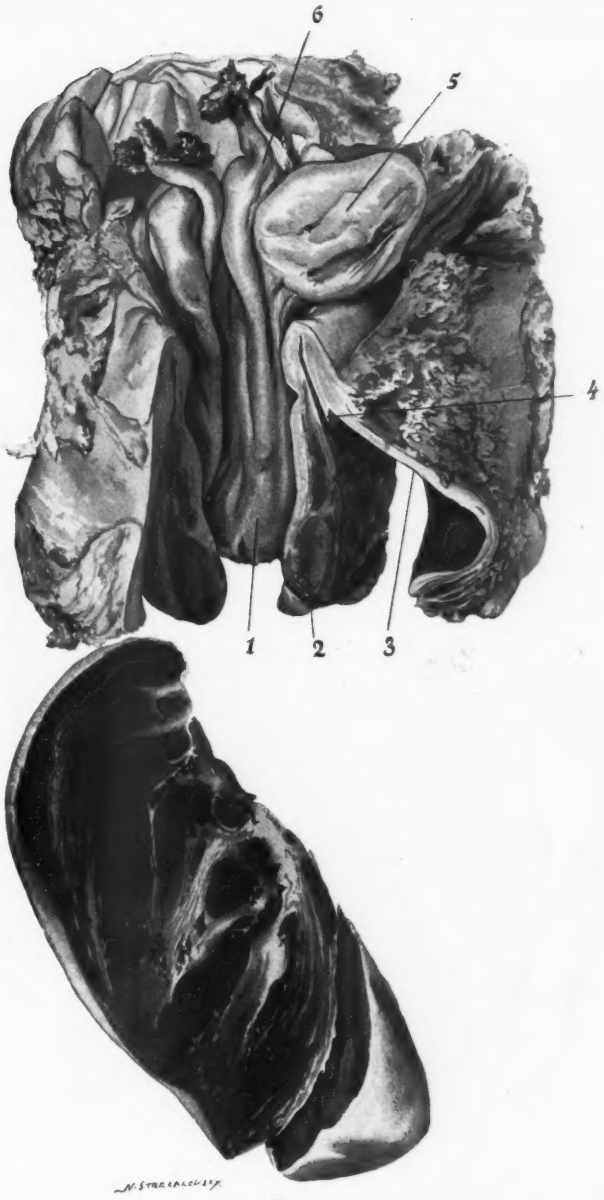



FIG. 9

COMPLETE INVERSION OF THE UTERUS. SUBMUCOID FIBROID

The specimen was removed post-mortem from a patient who was admitted to hospital suffering from septicaemia caused by a sloughing submucous fibroid. Two days after admission to hospital, the uterus expelled the submucous fibroid and got completely inverted in the process of expelling the tumour. The patient died a few hours later from uncontrollable haemorrhage. The tumour is seen at the bottom of the jar separated from the uterus. Note how the uterine appendages are pulled into the cup-shaped depression caused by inversion of the uterus.

1. The inverted serous surface of the fundus uteri. 2. Myoma at fundus.
3. Vagina. 4. Cervix. 5. Ovary. 6. Fallopian tube.



UNIV. OF MICH.

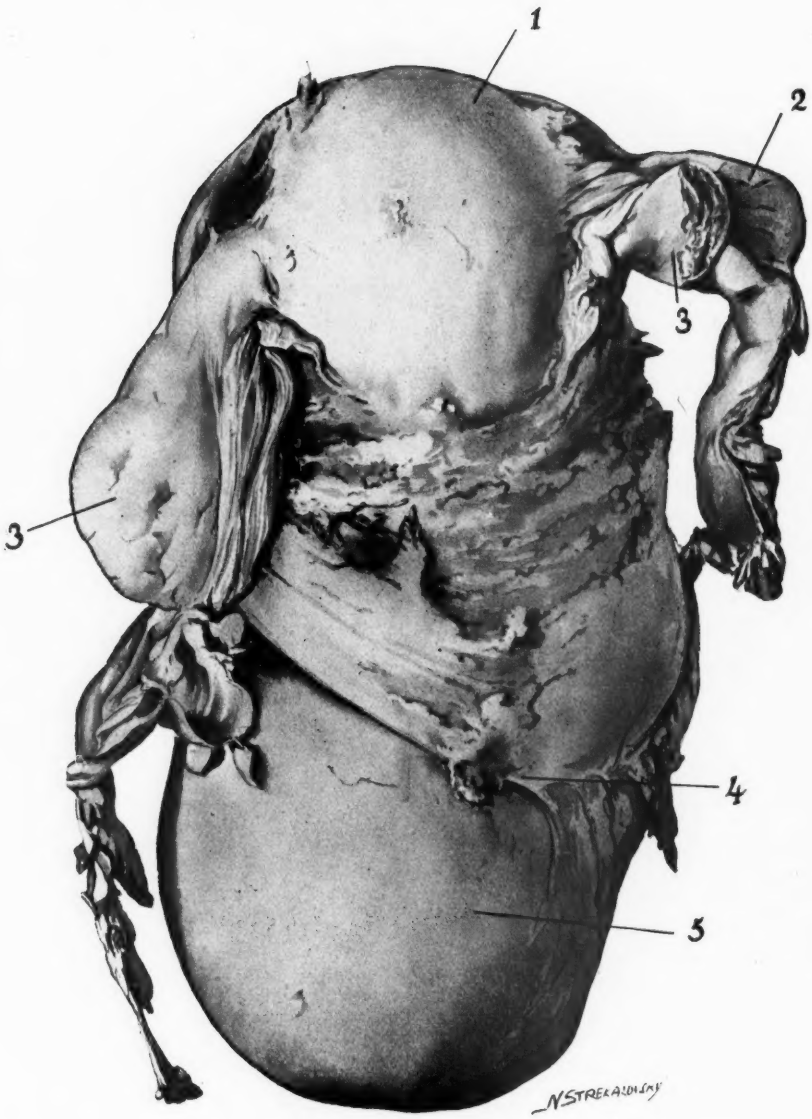



FIG. 10

UTERUS. SUBMUCOUS FIBROMYOMA

The uterus and adnexa have been removed by total hysterectomy. A big necrotic fibroid polypus, the size of a big orange, is seen projecting from the cervix. The patient, about fifty years of age, was admitted to the hospital for operation with symptoms of general septic peritonitis.

1. Uterus. 2. Uterine tube. 3. Ovary.
4. Dilated cervix. 5. Fibroid polypus.

FIG. 11

FIBROID IN THE POSTERIOR WALL OF THE UTERUS SIMULATING RETROFLEXION

The specimen was removed from the body of a patient who died as a result of a systemic disease. Several years before her death she had a ventrifixation performed on her. The surgeon who performed the operation mistook the fibroid on the posterior wall of the uterus for retroflexion.

UNIV. OF MICH.

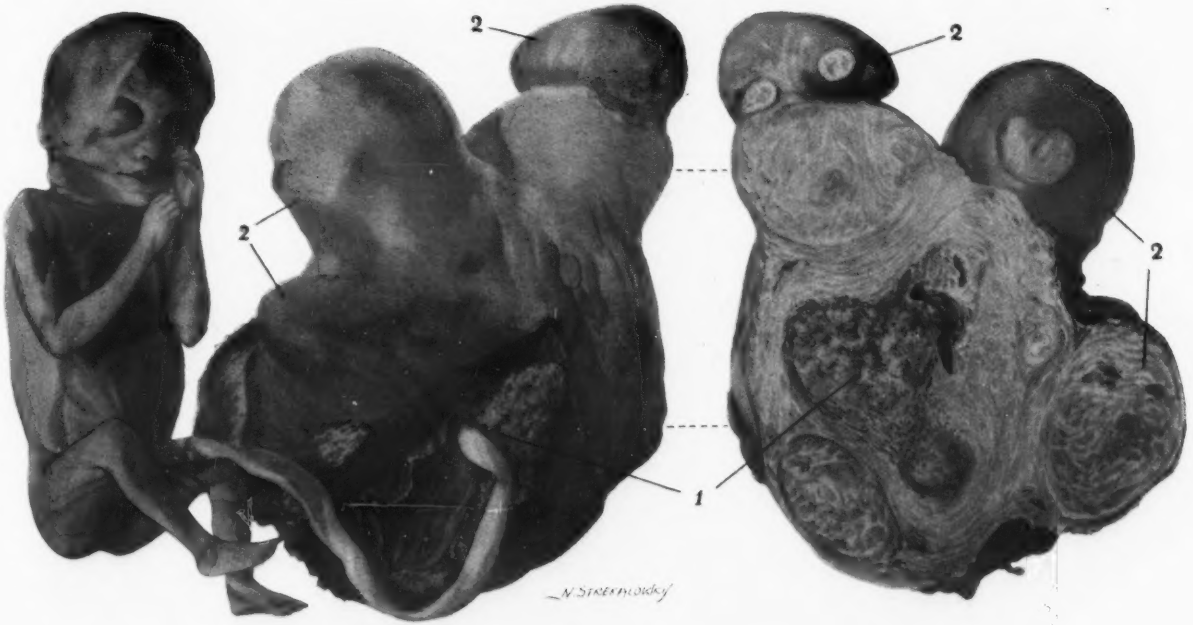



FIG. 12

Subtotal hysterectomy performed at the fourth month of pregnancy on account of severe haemorrhage.

1. Placenta. 2. Myomata.

The specimen was kindly presented for the Museum by Dr. Diasty of Mansoura.

'404A. *Mahfouz's Obstetrical and Gynaecological Museum.*

UNIV. OF MICH.

FIG. 13

UTERUS. MULTIPLE MYOMATA

A big subserous fibromyoma which was twisted on its pedicle, giving rise to signs of peritonitis. The pedicle of the tumour is attached to the lateral side of the uterus which is the seat of multiple subserous and intramural fibromyomata.

343. *Mahfouz's Obstetrical and Gynaecological Museum.*

UNIV. OF MICH.

and its identity was proved by histopathological examination. Brewer suggests four possibilities to explain the growth of this tumour:

1. Implantation from a small fragment of the fibroid removed in the previous laparotomy.
2. New growth from subperitoneal mesoderm.
3. Teratoma.
4. New growth from the urachus.

He concluded that the first suggestion appeared to be the most probable.

Steiner[88] in 1939 published a complete report on a case of metastasizing fibromyoma of the uterus with secondaries in both lungs. The tumour, both in the primary growth and in the metastases, was of benign appearance with smooth muscle cells and dense connective tissue. This distinguished it from primary leiosarcoma of the uterus. Steiner, after a detailed discussion, concludes that: "These tumours are so rare that some authorities, among them Ewing, have expressed doubt of their existence."

## Indications for Operation

In our series the chief indications for operation were, in their order of frequency: uterine bleeding, sterility, and pain. In most patients one or more of these main symptoms were accompanied by other less important symptoms, such as backache, dysmenorrhoea, leucorrhoea, frequency of urine, constipation, or abdominal tumour. Dragging pains and sense of weight in the pelvis were also frequently present, especially when fibroids of moderate size were associated with laxity of the uterine supports or descent of the uterus. In many instances symptoms of pressure were present in patients in whom the tumour was allowed to attain immense proportions before treatment was sought.

In our series menorrhagia was the commonest symptom that brought patients for treatment. Kelly,[89] Cullen, Graves,[90] and others, stress this symptom as the chief feature of the clinical picture, while Davis and Cusik, in a study of 335 cases, find that pain was the chief feature in 54 per cent, while menorrhagia was present only in 24.6 per cent.

It is interesting to note that in our series sterility was the second chief indication for operation. The social conditions in our country render fertility of the highest importance to the

patient. This has called for a determined effort to save the uterus for conception whenever this was feasible.

*Surgical Treatment.*

Patients treated by operation, 931. Of these, 156 were private patients operated upon at the Coptic Hospital, while 775 were patients of the hospital class on whom the operations were performed at Kasr el Aini Hospital (658) and at the Kitchener Memorial Hospital (117). Among the 658 patients operated upon at the Kasr el Aini Hospital 168 of the operations were performed by our friend and colleague Professor Ahmad Shafeek Bey.

*Mortality.*

Of the 931 patients, 459 were treated by subtotal hysterectomy, with 9 deaths, a mortality of 1.96 per cent; 362 patients were treated by abdominal myomectomy, with 5 deaths, one in a woman pregnant in the 4th month, who died suddenly of pulmonary embolism on the 10th day after the operation; her pregnancy had not been disturbed. One died of shock, and 1 of secondary haemorrhage. Two died of peritonitis (a death-rate of 1.38 per cent). Vaginal myomectomy was performed on 93 patients, with 4 deaths. In more than 60 per cent of these patients the tumour presented in the vagina, and in several instances it had attained a very large size and had become the seat of extensive necrosis and death resulted from ascending septic infection or septicaemia. Many of the patients were in a poor general condition after years of haemorrhage and infection. Their resistance was definitely low.

Total hysterectomy was performed on 18 patients, usually with removal of both adnexa. The chief indications for this more extensive operation were the presence of cervical fibroids, gross inflammatory lesions of the Fallopian tubes and ovaries, or gross pathological changes in the cervix. Of the 18 patients 3 died, a mortality of 16.6 per cent. This large increase in the death-rate was the result of associated tubo-ovarian infective lesions. This corroborates Schmitz's[91] and Greenhill's[92] statement that the death-rate of hysterectomy is increased tenfold in cases of associated inflammatory lesions of the adnexa. In one of our patients early malignancy was observed in the cervix.

The total death-rate for the 931 patients is 21, or 2.5 per cent. Of these, 3 died of myocardial failure (14.2 per cent); 3 died of shock and haemorrhage; 2 died of pneumonia (9.5

per cent); and 1 of pulmonary embolism (4.7 per cent). Uraemia also accounted for 1 death, following total hysterectomy. The chief cause of death was peritonitis, which accounted for 52.3 per cent of the total mortality. This agrees with the figure of Greenhill of 50.8 per cent, but fatal pulmonary embolism occurred only once in our series (4.7 per cent) as against 13 per cent in the series of Greenhill. Embolism was noted in only 3.8 per cent of 3,129 hysterectomies reported by Schmitz. The most frequent cause of death in the latter series was also peritonitis, which accounted for 46.2 per cent. This complication is much more evident when fibroids are associated with tubo-ovarian inflammatory lesions. These were present in 28 per cent of our patients. Our total death-rate of 2.25 per cent also nearly agrees with that of the cases reported by Schmitz, which amounted to 2.1 per cent.

## Choice of Operation

It has been our practice to perform myomectomy on all cases of fibroids of the uterus if the patient was in the child-bearing period, and particularly when she was sterile or had only one or two living children, provided that the operation did not carry any more risk to the patient than hysterectomy and left the patient with a uterus that may become pregnant and is likely to stand the strain of pregnancy and labour. If the Fallopian tubes or ovaries were found irreparably damaged, or if the connexion of the former with the uterine cavity was such as to make a future pregnancy unlikely, hysterectomy was performed.

The great advantage of myomectomy is that it preserves the function of the uterus. Bonney[93] also stresses the importance of the sexual and psychological influence of preserving the uterus. In Mayo's[94] series, 43 living children were born to 504 patients treated by myomectomy. Goullioud[95] reported the birth of 15 children to 55 women treated by this operation. In our series of 455 myomectomies conception followed in 117 patients. Of these 19 terminated in abortion or premature labour, while 98 went to term and living babies were born. Three of these cases deserve special mention. One was a schoolmistress operated upon at the age of 38, after 10 years of sterile marriage. The uterus was 2 fingers above the umbilicus. Besides sterility the patient suffered from severe dysmenorrhoea and menorrhagia. At the operation the uterus was found to be

the seat of numerous subserous and interstitial fibroids, and a total of 53 tumours were enucleated. A living baby was delivered by the forceps at the Coptic Hospital within 16 months of the operation. The second was a patient of 40 years. She had four daughters, the youngest was 10 years old, and she was anxious to have a son. On examination, the uterus was found greatly enlarged by multiple fibroids. The fundus was midway between the umbilicus and the ensiform cartilage. At the operation 61 tumours were enucleated. Within 12 months a living baby boy was delivered by the forceps at the Coptic Hospital. The third case was a patient of 42 years. She was married twice, and had never conceived. The uterus was two fingers' breadth below the umbilicus. Menorrhagia was moderate. Seven fibroids were enucleated. She conceived within 18 months of the operation. Her pregnancy was complicated by placenta praevia. Conservative measures were adopted up to the 40th week of gestation, when Caesarean section was performed, and a living boy was delivered. Two more fibroids, each the size of a large lemon, were discovered and removed.

When dysmenorrhoea is the chief complaint of the patient before operation, the effect of myomectomy on subsequent menstruation is all that can be desired. It happens occasionally that dysmenorrhoea is not completely relieved, while oligomenorrhoea is liable to follow if a good part of the endometrium has to be removed, as in cases of sessile submucous fibroids. Conservation of the endometrium is important, even in those cases in which the cavity of the uterus is dilated. One must remember that the endometrium involutes in common with the muscle of the uterus after removal of the tumour.

Unfortunately, myomectomy is not without its disadvantages. In nearly 5 per cent of our cases recurrence occurred. Our death-rate, for the abdominal operation, of 1.38 per cent compares with the death-rate of 1.96 for subtotal hysterectomy. But this low death-rate is the result of a careful choice of cases and the rigid exclusion of undue risk. In fact in patients in whom the number of tumours is numerous, and several incisions are found necessary, the death-rate rises to 6 per cent. The death-rate also rises sharply if the cavity of the uterus is opened during the enucleation of the fibroids. In our vaginal myomectomies the total death-rate was 4.3 per cent.

When hysterectomy is considered necessary, the subtotal operation is always performed in preference to the total operation, unless the cervix is diseased or is the seat of a fibroid.

Cancer of the cervix is comparatively less common in Egypt than in Europe or America. We have not yet met with carcinoma of the cervical stump, and in our series of 931 cases only one patient had carcinoma of the cervix in association with fibroids. Our findings in this connexion agree with those of Danforth[96] and many others. Polak[97] and Hartman,[98] however, give a figure as high as 2 per cent as the rate of the advent of carcinoma in the cervical stump, while Hochman,[99] Prestini,[100] and Tesaurs[101] give figures of 0.27 per cent to 0.54 per cent.

## Technique of Myomectomy

In our earlier operations we used the vaginal route extensively. We have on several occasions removed large submucous and interstitial fibroids by splitting the cervix, or by performing vaginal hysterectomy. Small tumours were enucleated, while large tumours were morcellated. The largest tumour we removed by this method weighed 5 kilos and 300 grammes (12 pounds). The patient was referred to one of us by the late Professor Dobbin. She was a multipara aged 32 years. The fundus of the uterus was one finger's breadth above the umbilicus, while the lower pole of the tumour, felt through the partly dilated cervix, bulged into the cavity of the uterus, and was necrotic. Vaginal myomectomy with morcellation was performed. The patient conceived 5 months later, and was delivered by the forceps at term of a male child.

Of late years we have modified our method of approach, and we reserve the vaginal route to cervical myomata or to necrotic or septic submucous fibroids only. In all other cases the abdominal route is followed. In performing abdominal myomectomy we adopt the usual technique of shelling out the tumour or tumours through well-placed incisions, carefully obliterating the cavity left, and paying particular attention to haemostasis and peritonization. Several tumours may be removed through one incision. It is frequently possible to incise the muscle (from the cavity left after enucleation of one tumour) to neighbouring tumours and to shell them out without resort to additional incisions. In placing our incisions we consider the direction of the blood supply, and we carefully avoid the region where the Fallopian tubes are attached to the uterus. Injury to the uterine ostium of the Fallopian tube will forfeit the greatest advantage of myomectomy. We find that digital compression of the uterine vessels during the operation is sufficient in most

cases to control the bleeding. We rarely make use of clamps for this purpose. Digital pressure can be readily relaxed, momentarily, whenever required to test the efficiency of haemostasis at any stage of the operation.

Bonney favours the use of a clamp, and was able through its use to remove as many as 125 fibroids from one uterus. Counsellor[102] advises the injection of 1 to 2 c.c. of posterior pituitary extract into the tumour before removal to minimize the loss of blood. He claims that by this method blood is driven from the tumour to the general circulation, and the loss of blood is small. In our hands the results were not marked. This is probably due to the fact that the vaso-pressor effect of pituitrin offsets its value by raising the general blood-pressure. Pitocin would probably give better results. Traction on the uterus during operation is valuable in reducing the loss of blood.

## Fibroids in association with Pregnancy

Owing to the frequency of sterility in patients with uterine fibroids the incidence of pregnancy among such patients is usually underestimated. Figures varying between 1 per 1,000 to 1 per 4,000 are usually quoted. Schauta, in a series of 55,311 consecutive labours, found that myomata existed in 0.1 per cent. Pinard found the tumour to be associated with pregnancy in 0.6 per cent of 13,915 consecutive deliveries. Pierson, in 1927, reported a similar incidence of 0.68 per cent among 50,000 labours at the Sloane Hospital for Women. Campbell noted an incidence of 0.46 per cent in the Williams' Maternity Service up to the year 1927.

It must be remembered, however, that only 50 per cent of the patients complain of symptoms due to the tumour, the existence of which must, therefore, be missed in many cases. Interference with the gestation is surprisingly infrequent. On the other hand, when symptoms arise, they are liable to assume a most alarming nature. Fibroids may produce serious symptoms as a result of degeneration or pressure. They favour malpresentations, primary uterine inertia, and post-partum haemorrhage. They may present serious obstruction to the passage of the foetus in labour. Placental adhesions, and placenta praevia, appear to be more common with fibroids, while retention of the placenta in the 3rd stage of labour may arise as a result of a low-placed fibroid tumour.

The risk of abortion has been attributed to haemorrhagic

and other pathological changes in the decidua, to faults in the position or the development of the placenta, or to mechanical interference with the growth of the contents of the gravid uterus. Pinard had 14 abortions among 84 patients, an incidence of 15 per cent. Pierson, among 191 patients, found that the incidence was as high as 24 per cent. Among his patients 2 aborted in the first 3 months of gestation, and 20 miscarried between the 3rd and 7th month, while 19 had premature labour. The inclusion of the latter have no doubt materially swelled the incidence.

It is rare to meet with obstruction in labour as a result of fibroids. Munro Kerr has pointed out how frequently it is that tumours which during pregnancy or early in labour appear likely to cause obstruction, are later raised up by the retraction of the upper uterine segment so that the genital passage becomes free. Williams mentions a particular case in which he advised the patient to report at term for Caesarean myomectomy only to find that the tumour had already become abdominal. Labour was entirely normal. In our experience we have repeatedly found occasion to confirm this fact.

Malpresentations are not uncommon. Olshausen found that in 304 cases of fibroids the vertex presented in only 53 per cent. The breech presented in 24 per cent, and in 19 per cent the lie was oblique. Schauta, however, noted malpresentations in only 8 per cent of his cases. Williams, among 82 cases, noted abnormal presentation in 16, an incidence of 19.5 per cent.

When labour is normal the incidence of post-partum haemorrhage is not excessive. Watson met with 3 cases only among 157 deliveries of patients with fibroid tumours. Inertia is much more common. Pierson found inertia in 34.6 per cent of 250 cases.

### Myomectomy during Pregnancy

We have met in our practice with a large number of fibroids in association with pregnancy, but our practice has been mainly conservative. If complications did not occur, we waited until labour started. In most cases labour terminated normally, while in a few assistance *per vaginam* was all that was required. Caesarean myomectomy was performed on 12 patients. In one of these a large retroperitoneal fibroid blocked the pelvis, and was so adherent that it could not be removed. The patient had two subsequent Caesarean sections, and the tumour remained stationary in size. The fibroid neither atrophied nor enlarged. All the operations were performed at term, either before or soon

after the onset of labour. All the babies, except one, survived. In one case Caesarean hysterectomy had to be performed owing to uncontrollable haemorrhage.

In 15 cases we had to perform myomectomy during pregnancy owing to degeneration or torsion during the 4th and 5th months of gestation. Three patients miscarried. We have made use in recent years of large doses of the progestin hormone injected intramuscularly before and after the operation, as well as sedatives, and since none of our patients have miscarried.

Winter[103] puts the risk of abortion after myomectomy at 17 per cent, and De Lee[104] stresses the increased loss of blood during the operation owing to hyperaemia of the uterus. Thomas[105] recently reported 3 patients who all went to term after the operation. Gemmell,[106] in an excellent survey of myomectomy, states that modern practice does not favour interference with fibroids during pregnancy. In the series collected by him from various sources all over the world, the mortality for myomectomy during pregnancy was 2.94 per cent, which is rather higher than the figure for patients operated upon in the non-pregnant state. The rate of miscarriage was 14.04 per cent. Among our 15 patients 1 died suddenly of pulmonary embolism on the 10th day after operation. This gives a death-rate of 6.5 per cent. The rate of abortion among our 15 cases was 20 per cent, but this has since been greatly reduced by the use of progestin as well as morphia. According to Gemmell 80 per cent of the patients subjected to the operation during pregnancy have living children. Bonney has removed as many as 7 fibroids from a pregnant uterus without interfering with the pregnancy.

## Post-partum Atrophy

Playfair[107] was the first to report a typical observation of 2 fibroids of the size of an orange which apparently disappeared after labour, but reappeared at a later period.

In our practice this has happened in 8 patients. In 10 others the tumours did not recur after atrophy.

## Radiological Treatment of Fibroids

Treatment of fibroid tumours of the uterus by X-rays and radium has been advocated by Werner,[108] Clark,[109] Polak,[110] and others. Combined surgical and radiological treatment has been advised by Adler.[111]

Essen Möller[112] rightly pointed out that in cases in which undue operative risk does not exist, radiological therapy is out of the question, as the operation gives a surer cure. Operative treatment conserves the ovaries and in many cases leaves the uterus in a condition fit for child-bearing.

In the selection of cases for these two alternative treatments we always took into consideration the safety of the patient and the efficiency of the method to be adopted. Radiological treatment has its place in the treatment of inoperable tumours, or of patients who are bad operative risks. It is suitable for tumours of moderate size in women approaching the menopause with menorrhagia as the chief symptom, provided that the tumours are not submucous.

Unfortunately, treatment by irradiation is not always successful. We have in our gynaecological museum 5 specimens of uteri removed from women in whom efficient radiological treatment failed to reduce the size of the growth or stop the menorrhagia and metrorrhagia. In 4 other cases the bleeding stopped and the tumour was reduced in size, only to grow again rapidly after 2 years of freedom from symptoms. On surgical removal extensive degeneration of the tumour was found. Malignancy was not discovered on histological examination.

In view of the doubtful nature of the response of the growth to irradiation and of the unreliable results obtained, surgical treatment still remains the method of choice in all cases in which it can be safely applied, while in women who apply chiefly for sterility, and in women under 40 years of age, in whom operation is safe, it is the only treatment which should be considered.

### Metropathia at the Menopause.

Women at or near the menopause frequently suffer from persistent and troublesome uterine bleeding, and on examination 1 or 2 fibroids of moderate size may be discovered. The bleeding in such cases may be due to metropathia haemorrhagica, or to the tumours present; while the existence of malignancy cannot be ignored. It is our practice in such cases to begin treatment by giving the patient progestin hormone in 5-milligramme doses injected into the muscles of the buttock every 3rd day for 2 months. In a large number of the patients bleeding stops. In patients in whom this treatment proves refractory, curettage is performed, and the débris examined histologically. It sometimes happens that a small polypus is removed at the curettage.

If haemorrhage recurs after curettage, or if the examination of the material removed showed malignancy, hysterectomy is performed. In the latter case radiological treatment is started after the operation.

## Treatment of Fibroids by Intramuscular Injection of Synthetic Testicular Extracts

For the last 3 years we have treated a few cases of moderate-sized fibroids with intramuscular injections of testoviron, 25 mgm. twice a week for 4 weeks. The treatment is again resumed after 1 month's rest. In some cases 4 or even 6 courses were given. The effect of the treatment on the size of the tumour and on the menorrhagia was variable. In some patients the result was satisfactory, while in others improvement was not marked. The number of patients thus treated is too small to allow us to judge on its efficacy.

In conclusion, we wish to offer our thanks to Prof. Ahmad Shafeek Bey for permission to include in our statistics operations performed in his own wards; and to Dr. Sadik and Dr. Hamamsy for their careful compilation of statistics. We are greatly indebted to Dr. Boulgakov, curator of the Faculty's museum, for his valuable preparation of specimens, and to Mr. Strekaloviski, the Faculty's artist, for his beautiful drawings.

### References

1. Avicenna, "Al Kanoon," Vol. ii, p. 598, Boulac Edition.
2. Meckel. "Handbuch der Pathol. Anat.," Leipzig, 1818.
3. Hyenne. *Thèse de Paris,* 1898.
4. Blanc. *Thèse de Montpellier,* 1900.
5. Guibé. "De la calcification des fibro-myomes," *Thèse de Paris,* 1901.
6. Ryan, M. "Manual of Midwifery and Diseases of Women and Children," London, 1841, p. 387.
7. Ashwell. "Practical Treatise on Diseases of Women," London, 1845, p. 286.
8. Graves, W. P. "Obstetrics and Gynaecology," Curtis. Vol. ii, p. 745.
9. Hildebrand. *Berlin Klin. Woch.,* No. 25, Vol. ii, p. 745.
10. Hart and Barbour. "Manual of Gynaecology," third edition, 1886, p. 401.
11. Schroeder, *loc. cit.,* p. 279. Leopold, *Archiv. f. Gynäkol.,* 1878, xiii, 182.
12. "Traité de Gynaecologie Pozzi," fourth edition, 1905, Tome i, p. 369.
13. Falk, E. (*Loc. cit.*)

14. Schatz. Congrès Gynéc. de Halle, 1888. *Zentralb. f. Gynäkol.*, 1888, p. 594.
15. Zweifel. Congrès de Gynécol. de Berlin, 1899.
16. Brietenberg. *Wiener med. Presse*, 1898, p. 1378.
17. Howitz. *Annal de Gyn. et d'Obst.*, 1896, p. 687.
18. Tripier. Hyperplasies conjonctives des organes contractiles: de la faradisation dans le traitement des engorgements et des déviations de l'utérus et de l'hypertrophie prostatique (Comptes rendus de l'Acad. des Sciences, août, 1895, et leç. Clin. sur les mal. des femmes, 1883). For the history of this question see Garlet. Du trait élect. des tum. fibreuses de l'utérus d'après la méthode du Dr. Apostoli (Th. de Paris, 1884). Egbert Grandin. "Cyclop. of Obstet. and Gynecol.," New York, 1888, Vol. v. Hor. Bigelow. "Gyn. electro-therapeutics," Londres, 1889.
19. Cliniselli (de Crémone.) Mém. presented to the Society of Surgery of Paris, 1869.
20. Martin, A. "On fibromyomata of the uterus and their treatment by the electro-atrophic action of the continuous current." (*Ann. de Gyn.*, February, March, April, 1879.)
21. Chéron. *Rev. de malad. des femmes*, 1879 et 1880. *Gaz. de Hôp.*, 11, 13, 18 March, 1879.
22. Apostoli. Comptes rendus du Congrès Français de Chir., 1889.
23. Avicenna. "Al Kandon," Vol. ii, p. 603.
24. Ryan, M. "Manual of Midwifery and Diseases of Women and Children," London, 1841, p. 387.
25. Ashwell. "Practical Treatise on Diseases of Women," London, 1845, p. 483.
26. Hofmeier. *Zeitschr. f. Geb. u. Gynäkol.*, 1880, v, 96.
27. Von Antal. *Zentralb. f. Gynäkol.*, 1882, p. 463.
28. Trenholme. *Amer. Journ. of Obstet.*, 1876, p. 702.
29. Hegar. "Die Castration der Frauen" (*Volk. Samml. Klin. Vort.*, 1878. p. 42); "Ueber castration" (*Zentralb. f. Gynäkol.*, 1879, p. 529). "Operative gynakologie," 1886, Second Edition, p. 341.
30. Velpeau et Chassiagnac. *Bull. de la Soc. Anat.*, 1833, p. 113.
31. Lisfranc. *Clinique de l'hôpital de la Pitié*, 1843, iii, 172, 178, 179.
32. Amussat. *Revue Medicale*, 1840, août, et "Mémoire sur l'anatomie pathol. des tumeurs fibreuses de la matrice et de la possibilité de les extirper lorsqu'elles sont encore contenues dans les parois de cet organe," Paris 1842.
33. Atlee, W. L. "The surgical treatment of certain fibroid tumours of the uterus, heretofore considered beyond the resources of art," Philadelphia, 1853.
34. Sims, Marion. *New York Med. Journ.*, 1874, xix, 337.
35. Brown, Baker. "Obstetrical Transactions," London, 1862.
36. Duncan. *Edin. Med. Journ.*, 1867, xii, 706.
37. Emmet. "The Principles and Practice of Gynaecology," third edition, p. 587, London, 1885.

38. Wells, S. "Voy. Zweifel, Die Stielbehandlung bei Myomectomie," p. 32. L'opération de Spencer Wells, date du 12 janvier 1862.
39. Martin, A. "Naturforscher-Versammlung in Cassel," 1878. *Deut. Med. Woch.*, 1880.
40. Schroeder. Soc. de Gyn. de Berlin, 1893.
41. Hegar. *Zentralb. f. Gynäkol.*, 1886, xl, 649.
42. Küstner. *Zentralb. f. Gynäkol.*, 1884, i.
43. Schauta. Comptes rendus du Congrès Gyn., 1895, Vienna.
44. Kelly, Howard A. *Journ. Amer. Med. Assoc.*, October 1897.
45. Polk. Congrès de Washington, 1894.
46. Noble. *Journ. Amer. Med. Assoc.*, October 1897.
47. Dudley. *Bost. Med. and Surg. Journ.*, 1894, xii.
48. Heath, A. M. "Case of excision of the uterus by the abdominal section," *London Medical Gazette*, Vol. I, New Series, December 8th, 1843-44, p. 309.
49. C. Clay. "Observations on ovariotomy, statistical and practical, also a successful case of entire removal of the uterus, and its appendages," *Trans. Obstet. Soc. of London*, 1863, v, 58.
50. Bellinger, J. "Operations for the removal of abdominal tumours," *South Journ. of Med. and Pharm.*, 1847, xi, No. 3, 241.
51. Burnham, W. "Extirpation of the uterus and ovaries for sarcomatous diseases," *Nelson's North American Lancet*, 1854, viii, article 36, 147. Irish, Jno. C. "Hysterectomy for the treatment of fibroid tumours: with a report of 15 cases," *Trans. Amer. Med. Assoc.*, 1878, xxix, 447. Report of Burnham's case.
52. Kimball, G. "Successful case of extirpation of the uterus," *Boston Med. and Surg. Journ.*, 1855, iii, No. 13, 249.
53. Koeberlé, E. "Documents pour servir à l'histoire de l'extirpation des tumeurs fibreuses la matrice par la méthode subpublienne," *Gaz. Méd. Strasburg*, 1864, ii, 17; iv, 66; ix, 158: 1865, iv, 78; vi, 118.
54. Kleberg. *Saint Pétersburg Med. Woch.*, 1877, September 24th to October 6th, p. 333.
55. Martin. *Traité de Gynécol.*, 1905, i, 427.
56. Dorff. *Zentralb. f. Gynäkol.*, 1880, 265.
57. Kocher. *Traité de Gynécol.*, 1905, i, 427.
58. Schroeder. *Tageblatt der 52 Versanml. deut. Naturf.*, 1879, No. 8, p. 308; *Arch. f. Gynäkol.*, 1880, xv, 271.
59. Spencer Wells. *Brit. Med. Journ.*, 1878, ii, 129; 1880, 315; 1881, i, 303.
60. Czerny. *Zentralb. f. Gynäkol.*, 1879, 519.
61. Olshausen. *Deutsche Zeits. f. Dis.*, 1882, lxvi, 171.
62. Hofmeier. *Verhandl. der Deutsch. Gessel. f. Gynäkol.*, 1888, 144.
63. Chrobak. *Zentralb. f. Gynäkol.*, 1891, xxxv, 713.
64. Stimson, Lewis A. "Ligation of the uterine arteries in their continuity as an early step in total or partial abdominal hysterectomy," *New York Med. Journ.*, 1889, xix, 277.

65. Baer, B. F. "A supplementary paper upon supravaginal hysterectomy by the new method," *Trans. Amer. Gynecol. Soc.*, 1893, xviii, 62.
66. McKay. "Lawson Tait: His Life and Work," London, 1922, p. 360.
67. Schroeder. *Zeitschr. f. Geb. u. Gynäkol.*, 1881, vi, 219.
68. Emmet, Thomas Addis. "Principles and practice of Gynaecology," Philadelphia, 1884, p. 612.
69. Goffe, J. Riddle. "A new method—The intra-abdominal but extra-peritoneal method—of disposing of the pedicle in supravaginal hysterectomy for fibroid tumour, with report of 4 successful cases," *Amer. Journ. Obstet.*, 1890, xxiii, 372: *Ibid.*, "The development of the intra-pelvic treatment of the stump after hysterectomy for fibroid tumour," *Trans. Amer. Gynecol. Soc.*, 1893, xviii, 79.
70. Goffe and Dudley. *Amer. Journ. Obstet.*, 1890, xxiii, 372.
71. Kelly, H. A. "Hysteromyomectomy and hysterosalpingo-oöphorectomy by continuous incision from left to right and from right to left," *Johns Hopkins Hosp. Bull.*, 1896, vii, Nos. 59 and 60, February and March, p. 27. "Operative Gynecology," New York, 1899. "The evolution of my technique in the treatment of fibroid uterine tumours," *Amer. Journ. Obstet.*, 1900, xlii, No. 3.
72. Pryor, William R. "Gynecology," New York, 1903. Also "A new and rapid method of dealing with intra-ligamentous fibromyomata," *Med. News*, 1894, lxv, 602.
73. Bardenheuer. "The first hysterectomy by the combined abdominal and vaginal method," *Zentralb. f. Gynäkol.*, 1881, No. 22, p. 519.
74. Péan in Sécheyron. "Traité d'hysterectomie," p. 735.
75. Martin, A. "Ueber Myome, Bericht Uber den Zweiten Kongress der deutschen Gesell. f. Gynäkol.," *Zentralb. f. Gynäkol.* 1888, No. 24, p. 398. "Ueber Myomoperation," *Zeitschr. f. Geburtsh. u. Gynäkol.*, 1890, xx, 1.
76. Doyen. Comptes rendus du Congrès de Gyn. et d' obst. tenu à Génève, 1896, ii, 113; and *Arch. prov. de chir.*, 1896, p. 625.
77. Davis and Cusik. *Amer. Journ. Gynecol. and Obstet.*, 1930, xix, 246.
78. Whitehouse, B. Eden and Lockyer's "Gynaecology," 4th edition.
79. Shaw, W. "Handbook of Gynaecology," 2nd edition.
80. Ashwell. "Practical Treatise on Diseases of Women," London, 1845, p. 290.
81. Simpson. *Traité de Gynécol.*, 1905, i, 346.
82. Schlagenhaufer. *Wien. Klin. Woch.*, 1902, No. 20.
83. Ulesko-Stronanowa. *Monats. f. Geb. u. Gynäkol.*, 1903, lxviii, Nos. 3 and 4.
84. Evans, N. *Surg., Gynecol. and Obstet.*, 1920, xxx, 225.
85. Quoted by Evans (see 84).
86. Kelly and Cullen. "Myomata of the Uterus," 1909.
87. Brewer, G. E. *Annals of Surg.*, 1921, lxxiv, 364.
88. Steiner, P. E. *Amer. Journ. Pathol.*, 1939, xv, 89.
89. Kelly. "Textbook of Gynecology," Appleton, New York, 1928.

90. Graves. "Textbook of Gynaecology," Saunders, 4th edition, 1928.
91. Schmitz, H. E. *Amer. Journ. Obstet. and Gynecol.*, 1937, xxxiv, 480.
92. Greenhill, J. P. *Amer. Journ. Obstet. and Gynecol.*, 1932, xxiv, 183.
93. Bonney, V. *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1922, xxix, 591: 1925, xxxii, 116; 1925, xxxivB, 840; *Journ. Amer. Med. Assoc.*, 1926, lxxxvii, 1530; *Lancet*, 1931, i, 171.
94. Mayo, W. J. *Journ. Amer. Med. Assoc.*, 1926, lxxxvii, 1530; *Northwest Med.*, 1922, xxi, 235; *Journ. Amer. Med. Assoc.*, 1917, lxviii, 887.
95. Goullioud. *Gynécol. et Obstet.*, 1929, xx, 523.
96. Danforth, W. C., *Amer. Journ. Obstet. and Gynecol.*, 1934, xxviii, 409.
97. Polak. *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1929, xxxvi, 325.
98. Hartman, quoted by Danforth.
99. Hochman, quoted by Danforth.
100. Prestini, quoted by Danforth.
101. Tesaurs, quoted by Danforth.
102. Counsellor, V. S. *Journ. Amer. Med. Assoc.*, 1937, cix, 1687.
103. Winter, quoted by De Lee.
104. De Lee. "Principles and Practice of Obstetrics," 1938, p. 567.
105. Thomas, R. C. *Brit. Med. Journ.*, 1939, i, 1085.
106. Gemmell, A. A. *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1936, xliii, 715.
107. Playfair, Forgue et Massaud. "Nouveau traité de chirurgie gynécol.," 1927, xliii.
108. Werner, P. *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1938, xlv, 780.
109. Clark and Block. *Amer. Journ. Obstet. and Gynecol.*, 1925, x, 560.
110. Polak, J. O. *Amer. Journ. of Obstet.*, 1918, lxxvii, 837.
111. Adler. *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1929, xxxvi, 335.
112. Essen Möller. "Nouveau traité de chirurgie clinique et opération." E. Forgue et G. Massaud, 1927, p. 320.

# Analgesia and Anaesthesia in Obstetrics

BY

H. R. GRIFFITH, B.A., M.D., C.M., F.A.S.A.,

AND

J. R. GOODALL,
*O.B.E.*, B.A., M.D., C.M., D.Sc., F.I.C.S. (Hon.), F.R.C.O.G.

IN any study of this subject, based upon experience, there are always two patients whose interests are at stake, the mother and the unborn baby. It is these double interests which make the subject so difficult, and cause it to differ so markedly from anaesthesia in surgery. There are, however, other factors of importance that make this subject more complicated and these are that means of analgesia which may be used in the 1st stage of labour are not applicable in the 2nd stage, and at no time is complete surgical anaesthesia desirable, except in operative delivery or in post-partum repairs.

Obstetrical analgesia and anaesthesia have many facets, not only of interest, but of first importance to a successful administrator in this field of work.

First of all, we must realize that analgesia means freedom from pain without complete ablation of the functions of the centres of orientation and reasoning. This state has for its aim the relief of pain with its consequent fatigue and shock without destroying co-operation between the patient and her medical attendants. Anaesthesia, on the other hand, implies a more or less submergence of all the cerebral faculties.

The question at once arises: is complete analgesia or complete anaesthesia desirable in obstetric practice?

This important question cannot be answered by the mere *ipse dixit* of any authority. For this reason we give here our combined experience as anaesthetist and obstetrician, where co-operation between these branches of obstetrics has existed for many years over a large number of cases. On the one hand, we are decidedly of the opinion that in the 1st stage of labour complete anaesthesia is so completely ultra as not to require any further comment. On the other hand, we believe that complete analgesia in this stage may be a *desideratum* by the theorists and by certain supersensitive and anticipating

patients, but as a scientific and safe measure it is not to be attempted. In the first place, pain is salutary in that it indicates pathology or abnormal function. We do not know and, therefore, will not attempt to debate, whether normal labour should be attended by pain. We do not know, owing to lack of experience, whether in the lower forms of animal life gestation is painless, and that, therefore, by its presence in the higher forms of life, painful gestation is an expression of vitiated function. All this is beside the question, but it is a matter of interesting speculation. However, it can be stated authoritatively that there is no obstetrician so skilled that he may definitely state that there is no disproportion or malpresentation in all cases, and if this is true of the highly trained obstetrician, how much more is it true of the casual accoucheur? Therefore, complete analgesia would mask any danger arising out of unrecognized or unappreciated intensity of uterine effort. There are no signs by which uterine effort can be measured infallibly. But a combination of symptoms and signs is our yardstick in such cases. They are:

1. Pain (subjective).
2. Pains (objective).
3. Effect of pains (engagement, descent, dilation, rotation, caput succedaneum, and expulsion).

No one of these is sufficient. Pain varies in wide limits owing to differences in patients' tolerance and self-discipline. Pains are appreciated objectively by the hand upon the abdomen to determine rhythm, duration, and hardness of the uterus, and by the effect upon the foetal heart, changes in the cervix, descent, and caput succedaneum. To eliminate any of these by complete analgesia would be tantamount to increasing the risk of unrecognized praeternatural action of the uterus against an unrecognized undue resistance and the result might, and probably would, entail the direst consequences to both mother and child. If one concedes that this is so, then we have a common basis as a beginning.

Another concession is that analgesics suitable to the 1st stage of labour are not those of choice for the 2nd stage. The reasons for this are many. First of all, throughout the 1st stage the mother is a passive agent in her pains. She cannot modify them by any effort of her will, though they may be greatly modified by strong emotion. The pains are those of squeezing of a hollow viscus which is the active force, acting against the resistance of the lower uterine segment. This can take

place equally well in women whose spinal cord has been accidentally severed low down, and who have no pelvic voluntary control whatsoever. The ideal analgesic, therefore, will be one which will reduce the pain, and thereby protect the central nervous system from too severe, or even severe, afferent impulses from the upper uterine segment. It will not be an agent which produces such a soporific state as to cause amnesia without protection to the nervous centres. This is a very important consideration. In this respect it is noteworthy that the barbiturates are not analgesics, but soporifics, and in huge doses will produce a mental torpitude of such a degree that all knowledge of the labour may be wiped out, but the appearance of the patient is such as to confirm the belief that the nervous system has not been immuned to the deleterious afferent impulses. Moreover, the variability in patients' reaction to the barbiturates is so great that even hyperexcitation is not infrequent in lieu of the expected usual reaction of somnolence. We are decidedly of the opinion that the derivatives of opium fill all the indications, both as regards patient and physician; and best among these are morphine and heroin. The action of each of these may be modified, either as an intensifier or as a prolonger of their action by the addition of adjuvants, and chief among these are hyoscin hydrobromate or scopolamine, and to overcome the depressing effect of the opiate element upon the maternal or foetal respiratory centres, atropine sulphate in appropriate dosage may be incorporated.

The use of the so-called twilight sleep has been greatly abrogated through the lack of ordinary common sense. Twilight sleep is now used in large clinical centres as the most effective 1st stage treatment. The idiosyncrasies are fewer than with any other drug or combination of drugs. It can be administered by any trained nurse, and it can be made to produce a degree of analgesia (and of amnesia if so desired) to satisfy the most exacting physician. The rules are few but of the utmost importance. First, the dose should be small at first, and should be repeated and graded to suit the individual patient; and second, the administration of the drug (and this applies to all narcotics) should not impinge at its full strength upon the 2nd stage of labour, in order not to have a too depressing effect upon the foetal respiratory centre, when this centre is called into action at the time of birth. This late effect of the opiates was not fully appreciated until recently. Even just a few years ago, morphine was usually administered to a prospective

Caesarean section to quiet her apprehension, and we had the most difficult time to make the child breathe after extraction. And it was not until the late Dr. Herbert M. Little pointed out that the result was due to the morphine. Since then, nembutal is used as a pre-anaesthetic sedative and the difficulty was immediately avoided.

Moreover, most children who die *in utero* during the 1st stage of labour do so owing to prolonged uterine spasm akin to "Charlie horse" in skeletal muscles. The quickest antidote is chloroform to relieve the spasm, but the best preventative of any possible or impending attack in susceptible patients is an opiate. Likewise the opiates are the best drugs to prevent a recurrence after the chloroform has relieved the spasm. The opiates, in our opinion, are the best regulator of rhythm and uterine rhythm is the best safeguard to the continuance of the child's welfare.

With these considerations in mind, there is no reason why the degree of analgesia and amnesia should not be suited to the most exacting patient and accoucheur. The action of the drugs begins in about 20 minutes and begins to waver after about 3 hours. The initial dose, when labour has been definitely established, is usually morphine gr. 1/6, hyoscin hydrobromate gr. 1/150 and atropine sulphate gr. 1/150. Usually the morphine gr. 1/6 is repeated in 1 or 2 hours, but if a deeper analgesia with amnesia is required the morphine and hyoscin may be repeated without the atropine. A repetition of the atropine increases the flushing of the face and the dryness of the throat which may be somewhat uncomfortable. By administering these drugs with caution one can arrive at a most satisfactory stage without any risk whatsoever. When the 1st stage has advanced considerably so that the degree of dilatation and effacement are more than half in any given case we may judge by rectal examination how long an interval will elapse before the 1st stage is completed by computing the length of time that was required to bring the cervix to its present stage of obliteration. It is one of the fixed rules in most maternity institutions that one must ascertain the degree of cervical dilatation before administering a second or higher dose of narcotic, for the reason given above, lest we carry the narcosis over into the time of delivery. The 2nd stage in primiparae is usually from 2 to 4 hours, so one can judge by this also whether further narcosis in the 1st stage be not only necessary, but also judicious. This rule will apply also to the use of twilight sleep

administration, and it has been the disregard of this rule, now applicable to all narcotics, that has brought scopolamine and morphine into disrepute. This consideration and the desire to produce complete amnesia damned twilight sleep for many years. And yet, if used with the same rules as those governing other forms of narcotics, the danger is infinitely smaller and the desirable effects are much enhanced.

A question immediately suggests itself. No matter what analgesic is used in the 1st stage, there is always, not only a possibility, but a probability, that a certain effect of this will be carried over to the child at birth in a certain percentage of cases, and if this be conceded, then children that are deeply asphyxiated at birth, with the added depressing influence of the drug carry-over, may succumb, when another similarly situated as regards asphyxia, but not hampered by the narcotic, might survive. That, I think, must be conceded, but as a counter to this, one will have fewer cases of such degrees of asphyxia by the maintenance of the proper rhythm by the action of the opiate. Morphine and its derivatives are notably muscle tonics, and are administered in all spastic conditions, and lack of rhythm or spasticity of muscles is an expression of faulty over-excitation.

Like all good things, the drug or its combinations may be used to the patient's disadvantage. There is a strong tendency on the part of some accoucheurs to build a reputation, among the womenfolk at five o'clock teas, upon complete analgesia and complete amnesia. The price calculated in heightened death rate in the offspring is always set down to some other cause that does not reflect upon the physician's judgment, or, shall we say, lack of judgment. In the 2nd stage of labour it is advantageous, for various reasons, that a degree of the analgesia be carried over into the early phases of this stage. Especially is this true of most primiparae whose 2nd stage may last from 2 to 4 hours. Whatever remarks are here recorded apply chiefly to hospital obstetrics, where the advantages of collaboration are at hand, and when not specifically stated this is implied.

In the 2nd stage one has to fall back completely upon general anaesthetics. The substitutes for these, such as spinal, caudal, local and perineal, have been chiefly experimental and rightly short-lived. In general obstetrical practice in the home, chloroform in Canada and ether in the United States have been universally the anaesthetics of choice, owing to their easy porta-

bility and their ease and safety of administration. In hospital practice these two properties do not carry the same weight.

Each of the general anaesthetics has some advantages and some disadvantages, and it behoves us to use those over which we have the most command engendered by our experience. Chloroform in spite of its toxicity has some advantages which are not possessed by any other anaesthetic.

Foetal distress in the 2nd stage may be due to many causes. In some of these, chloroform gives a prompt relief, but not so in others. It may repay to pass a few of these briefly in review.

Foetal distress may be due to acute or cumulative asphyxia, cerebral anoxaemia, cerebral oedema and cerebral haemorrhage. Acute asphyxia is due to prolonged impediment to the foetal and placental circulation, or to this may be added a degree of maternal anoxaemia, due to toxic states or imperfect oxygenation during anaesthesia. Factors which modify the foetal state are diseases of the foetus and infarctions of the placenta. For example, a degree of maternal anoxaemia, which might not jeopardize the normal foetus and placenta, might easily overcome a foetus fed by a greatly infarcted placenta.

Cumulative asphyxia is slow and insidious in onset. As labour advances in the 2nd stage, several factors diminish the size of the placental uterine surface, owing to the retraction of uterine muscle. These factors are: (1) the escape of the uterine fore- and after-waters; (2) the descent of the presenting part into the pelvic cavity; and (3) elongation of the lower uterine segment.

As labour advances in the 2nd stage, the pains grow more frequent, longer and more forceful, and the interval grows correspondingly shorter. The foetus must recover its oxygen and $CO_2$ balance in this interval. But owing to the above-mentioned circumstances, operating singly, or in combination, a degree of anoxaemia may be carried over after each pain, and by its accumulation asphyxia develops. At first, the foetal heart rate is accelerated; later it is slowed down, may lose its rhythm, vary in volume and audibility, and finally may cease altogether. In these circumstances chloroform, by relieving the pressure through weakening the uterine pains, causes the asphyxia to disappear quickly, and we know of no more dramatic therapeusis than to listen to the heart recovery of a potential life. Chloroform, in these circumstances, owing to ready accessibility and quick action, is the remedy incompar-

able. If, on the other hand, the foetal heart action be slow or show other signs of distress and this is not relieved by chloroform, then we are justified in suspecting cerebral injury due to prolonged cerebral anoxaemia, oedema or haemorrhage, and appropriate means ought to be adopted to meet the situation.

So much for the abnormal 2nd stage and its remedy. Let us now discuss the best anaesthetics in the 2nd stage in the following circumstances:

1. To relieve pain without unduly influencing the contractions.
2. For delivery by the forceps and repair.
3. For Caesarean section.

We must also consider the effect of any general anaesthetic upon uterine contraction and retraction; in neutralizing the results of ecbolics; upon placental separation and expulsion; upon intrapartum and post-partum haemorrhage.

Let us first deal with these last considerations before taking up the subject of 2nd stage anaesthetics in general.

1. *The Effect of General Anaesthetics upon Uterine Contraction and Retraction.*

All general anaesthetics, except cyclopropane, have a depressing effect upon uterine contractions and retraction, proportionate to the degree of anaesthesia produced and to the duration of that degree of anaesthesia. Intermittent anaesthesia with each pain produces, therefore, a minimum of change in the character of labour pains. This is the ideal in normal uterine action. In the expulsive state of the 2nd stage the anaesthetic may be used to the degree of almost complete suppression of the pains, and labour may be completed by hand compression, by episiotomy or by the forceps, without the assistance of pains. But general anaesthetics vary in their property of suppressing labour pains. We believe they vary in this respect in the following order: cyclopropane, nitrous oxide, ether, and chloroform. This, however, is not the order of their anaesthetic properties.

2. *The Effect of General Anaesthetics in Neutralizing Uterine Stimulants.*

We may take pituitrin as the common example of stimulant for discussion. It may be stated, as a general rule, that all

anaesthetics weaken the effect of uterine stimulants in the proportion of the depth of the anaesthesia produced. But chloroform and ether, in this order, are by far the most active anaesthetics in this respect.

3. *Their Effect upon Placental Separation and Expulsion.*

It has been our common experience that nitrous oxide anaesthesia definitely prolongs separation and expulsion of the placenta. But this is proportionate to the degree of anoxaemia produced in the administration. By stopping the anaesthetic and administering pure oxygen for a few minutes the defective uterine action is quickly remedied. Prolonged chloroform anaesthesia is conducive to slow separation of the placenta, and slow expulsion. Cyclopropane, on the other hand, is a powerful uterine stimulant, as Dr. Griffith will stress, in cases of Caesarean section. It promotes rapid separation and expulsion, and powerful uterine retraction.

4. *Effect upon Intrapartum and Post-partum Haemorrhage.*

As will be inferred from what has been written, anaesthetics vary considerably in this respect. Undue prolongation of deep anaesthesia is conducive to abnormal haemorrhage. But we think that ether is by far the anaesthetic which is most culpable for the development of conditions which bring about this abnormal loss, and it will be pointed out by Dr. Griffith in the following section that ether is now, in most of our obstetrical clinics, reserved for post-partum repair work.

For the relief of pain during the 2nd stage of labour, nitrous oxide is most satisfactory. The safe and effective use of this gas depends upon its administration by a properly qualified anaesthetist, who will intelligently take into consideration the progress of labour as well as the relief of pain. The mother must not be so deeply anaesthetized that she will cease to cooperate in the voluntary use of her pains; an adequate supply of oxygen must be maintained for both mother and baby; and the gas must be administered rapidly enough to bring relief. This calls for a skilful combination of obstetrical, anaesthetic, and physiological technique, and when properly carried out will afford the tired mother a great degree of comfort, will improve her morale, and often hasten the normal course of labour. We have found that the continuous administration of nitrous oxide

and air, as advocated by Sword,[1] is a very effective method in most cases. By this method the patient is kept in a slightly groggy condition by the continuous inhalation of 2 or 3 litres of nitrous oxide per minute, and the uterine contraction may be used more rapidly and effectively than if one must wait to secure pain relief with the onset of each contraction. The method is not easy, but in experienced hands is most satisfactory. For delivery of the baby, either spontaneously or by the forceps, nitrous oxide is not very satisfactory. It does not afford sufficient relaxation, unless the oxygen supply is dangerously reduced, and a too violent expulsion of the baby or uncontrollable excitement of the mother may result. For this reason, it has been our practice for several years to change to cyclopropane as soon as delivery is imminent. This valuable anaesthetic gas quickly provides adequate muscular relaxation, allowing at the same time a large amount of oxygen to both mother and baby, and does not affect the tone of the uterus. It is less toxic than chloroform or ether, and is more controllable.

We have used cyclopropane for more than 1,000 obstetrical deliveries, and we are convinced that in the hands of an experienced anaesthetist it is the safest and most satisfactory anaesthetic agent available at present for normal or operative delivery and repair. If cyclopropane is not available, or an experienced anaesthetist not present to administer it, we feel that vinesthene or open drop ether should be used for the delivery and repair. Chloroform may be used for a very short anaesthesia, but should never be used for a long repair operation in a mother who is already exhausted from a difficult labour. It must never be forgotten that chloroform, in spite of its convenience and relative pleasantness, is an organic poison; and there is no pharmacological evidence to support the long-held belief that a given quantity of chloroform is less toxic to a parturient woman than to any other patient.

For anaesthesia in Caesarean sections we have been fairly well satisfied with cyclopropane after using it in a series of about 250 such operations in our hospital during the past 6 years. Recent experience has confirmed our previous opinion[2] that the post-operative condition of mother and baby after cyclopropane anaesthesia is usually very satisfactory. The only possible objection to cyclopropane for Caesarean section is that during even deep anaesthesia the tone of the uterus is maintained to such an extent that delivery, especially by a low trans-

verse incision, is often quite difficult. However, even this might be called an advantage, since the maintenance of good uterine tone makes for better post-partum contraction and less haemorrhage. We believe that cyclopropane is better when given by itself without the addition of any ether—an unnecessary and often harmful combination.[3] Heard[4] has recently demonstrated the harmful effect of ether on babies during Caesarean section operations, and we agree with him on this point. When cyclopropane is not available or advisable, we believe that a low spinal anaesthetic with novocaine or pontocaine should be chosen for Caesarean section.

The relation between various anaesthetic agents used at delivery and asphyxia of the newborn is a subject which has given rise to much discussion and some unwarranted conclusions. Certain principles, however, are clear—first that any general anaesthetic agent which is administered to the mother will also anaesthetize the baby; and secondly, the sooner after birth the baby gets an adequate supply of oxygen the less danger is there of a harmful anoxia to brain or other organs. It seems to us, therefore, that there is obvious advantage to the baby in the use of a controllable, rapidly eliminated anaesthetic agent, such as cyclopropane or nitrous oxide, and also that there should be no delay in the effective administration of oxygen to the baby whenever the onset of spontaneous respiration is delayed. The anaesthetist, on account of his familiarity with problems of respiration, should be trained to take charge of any resuscitative measures which may be necessary for the baby. It is our practice to administer oxygen, either by face mask, or intratracheal catheter, and artificial respiration, to every baby which does not breathe adequately within the first 2 minutes of life. In this way, good oxygenation of the blood may be established whenever the heart is beating, and often long before spontaneous respiration begins in babies who are severely depressed. The technique is simple, but should be carried out only under the direction of an experienced physician. We are certain that the lives of many babies have been saved and their mental and physical well-being preserved by the prompt and efficient administration of oxygen after a difficult delivery. Carbon dioxide may be used in addition, but we feel that its value *per se* has been overestimated, and that it is the prompt introduction of oxygen into the baby's lungs through an open airway, plus artificial respiration, which is the real life-saving procedure.

All these considerations lead us to the conclusion that safe and satisfactory analgesia and anaesthesia in obstetrics is possible with drugs and equipment which are now available, but that good results can be expected only when there is intelligent co-operation between expert obstetrician and experienced anaesthetist. Each must understand the other's problems, and take into consideration the triple factors of progress of labour, pain relief and effect on the baby. Too often obstetricians and hospital authorities have been satisfied to delegate the administration of obstetrical anaesthesia to junior internes or nurses. It is the most difficult, not the simplest branch of anaesthesia; and for effective results modern scientific knowledge of physiology and pharmacology must be wedded to the art of obstetrician and anaesthetist.


REFERENCES

1. Sword, B. C., and H. B. Perrins. *Cur. Res. Anes. and Anal.*, 1937, (Sept.–Oct.) xvi, 249.
2. Morgan, G. S., S. G. Eaman, and H. R. Griffith. *Cur. Res. Anes. and Anal.*, March–April, 1937.
3. Leach, B. C., and H. R. Griffith. *Canad. Med. Assoc. Journ*, 1940, xlii, 434.
4. Heard, K. M. *Surg., Gynecol. and Obstet.*, (March) 1940, lxx, 657.

# Urological Complications of Carcinoma of the Cervix Uteri

BY THE LATE

T. F. TODD, M.S. (Lond.), F.R.C.S. (Eng.), M.R.C.O.G.

*Hon. Assistant Gynaecologist, Salford Royal Hospital; Research Fellow, Christie Hospital and Holt Radium Institute.*

THE clinical study of a large series of cases of carcinoma of the cervix uteri before, during, and after treatment has revealed an incidence of urological complications that is surprisingly large. The discrepancy between impressions and findings is apparently accounted for by two reasons, namely the frequency with which such complications do not give rise to urological symptoms, and the rarity, in this country, of urological investigation of gynaecological cases. For these reasons I decided to investigate fully the urinary tract in carcinoma of the cervix uteri, and my cases fall approximately into three groups: (1) cases not previously investigated, but coming to investigation because of the development of some urological complaint following treatment; (2) cases recognized in the course of a thorough investigation as to the possible aetiology of severe pain occurring subsequent to treatment; and (3) cases submitted to urological investigation before, during, and after treatment for the purposes of finding out the incidence of urological complications and the effect of radiation therapy on the urinary tract. The bulk of cases of this group belong to either stage 3 or stage 4 (League of Nations Classification), and the whole series has been investigated at the Christie Hospital and Holt Radium Institute during the tenure of a Research Fellowship.

The portions of the urinary tract most subject to involvement by carcinoma of the cervix are the bladder and the pelvic portions of the ureters. Involvement of the urethra, of the abdominal portions of the ureters and of the kidneys is usually a secondary phenomenon, either due to advancing malignancy, in the case of the urethra, or to back pressure from ureteral obstruction. An exception was the solitary case of renal metastasis which will be described subsequently.

## Résumé of Literature

The occurrence of urological complications in carcinoma of the cervix has been known for many years. Beatty[1] so far back as 1854 reported 3 patients dying of uraemia, and Wagner[2] in 1858 reported ureteral dilatation present in one-third of the cases of cervical carcinoma autopsied. Winter[3] in 1893 confirmed these findings in a similar study. Again, Williams[4] in 1895 reported a series of 78 autopsies on patients dying from carcinoma of the cervix and showing hydro-ureter and hydronephrosis in 86 per cent, but it is only recently that attention has been focussed upon them. Macalpine[5] states:

> Involvement of the ureter by carcinoma of the cervix is a very common complication of that disease, so much so that one-half of the mortality in unoperated cases is said to be due to renal back pressure and sepsis with its resulting uraemia. The importance of estimating the state of the upper urinary tract would seem to be sufficiently obvious, but this phase is still much neglected, though there are signs of an awakening to a realisation of its value.

That this is so is fully emphasized by the fact that practically all the literature on this subject has appeared in the last 12 to 15 years. Renand goes so far as to say that death from renal complications is only avoided when it is due to haemorrhage, peritonitis, or some such complication.

Series of autopsies on patients dying from carcinoma of the cervix have been reported by Warren,[6] Faerber,[7] and Behney.[8] Uraemia was the actual cause of death in 33 per cent, 11 per cent and 21 per cent respectively, but the incidence of hydro-ureter and hydronephrosis was much higher in each series. Holzbach[9] in 48 cases of carcinoma of the cervix studied at autopsy found 31 bilateral and 10 unilateral strictures. Pearson[10] in 57 cases studied post-mortem found 42 cases with unilateral stricture and associated hydro-ureter and hydronephrosis, 30 cases being bilateral and 12 unilateral. Infection is a frequent sequel to hydronephrosis and was present in 13 of these 42 patients. Ewing[11] stresses the frequency of renal failure as the actual cause of death in uterine cancer. He states that the pelvic ureters are commonly invaded from without from the parametrium, and while the wall long resists destruction partial or complete occlusion is readily established by cancerous infiltration or by inflammatory process. The ureter may also be invaded by extension through the vesical wall, and it may be occluded by inflammation extending upwards

from the bladder. Several writers confirm these opinions on clinical grounds. Hunner[12] says urological changes may be recognized in a large proportion of cases and may be an early feature. He stresses the importance of recognizing late obstructions, and the possibility of giving relief by ureteral dilatation. Graves, Kickham, and Nathanson,[13, 14] showed ureteral occlusion to be of common occurrence in carcinoma of the cervix once the disease had spread beyond the limits of the cervix itself. They fully endorse Macalpine's opinion, and consider that their findings justify complete urological investigation of all cases before treatment is instituted. Pomeroy[15] showed a pre-irradiation incidence of urological complications in 77 unselected cases of carcinoma of the cervix to be as follows:

| | |
|---|---|
| Normal bladder ... ... ... | 55 cases |
| Vesical wall involved ... ... ... | 20 cases |
| Vesical mucosa involved ... ... | 2 cases |

*Uroselectan findings.*

| | |
|---|---|
| Normal ... ... ... ... ... | 63 cases |
| Double hydronephrosis ... ... ... | 3 cases |
| Single hydronephrosis ... ... ... | 3 cases |
| Functionless kidney ... ... ... | 5 cases |

By excretion urography, Colby[16] showed the presence of partial or complete ureteric obstruction in over a third of 34 cases; in none of these was the blood-urea raised—an important observation in view of the general acceptance of a normal blood-urea as indicative of normal renal function.

Bugbee[17] reported 6 cases of nephrectomy for pyonephrosis developing secondary to ureteral occlusion following irradiation treatment of cervical carcinoma, the earliest case 5 months after treatment, and the latest 9 years. Two additional cases of patients coming to autopsy were also described: the first developed bilateral ureteral obstruction 1 month after irradiation, the actual obstruction being due to carcinomatous involvement of the walls of the ureters some 3 cm. from the bladder; the second developed carcinomatous obstruction of the left ureter 3 cm. from the bladder over 4 years after irradiation. Bugbee stresses the importance of investigation of the urinary tract in follow-up examinations of treated cervical cancer, since the possibility of ureteral occlusion on one or both sides, resulting in slow destruction of renal function, and possibly necessitating nephrectomy, must be considered. He reported in 1938[17A] a follow-up of these

cases and a further series of 9 cases in which the patients had renal lesions. All of the patients operated on had died, though one lived for years. In the second series none were fit for nephrectomy. Bugbee states that it is questionable if urological complications shorten the individual's life, as in all of them there is evidence of metastasis at the time of their appearance.

The aetiology of these urological complications is imperfectly understood. Howes and Strauss[18] describe the aetiology of ureteral obstruction as fourfold: (1) Inflammatory parametritis; (2) carcinomatous infiltration; (3) post-irradiation oedema (transient); and (4) post-irradiation fibrosis. They report an incidence of 52 per cent of ureteral obstructions in a series of over 100 cases. The treatment advocated is dilatation of the affected ureter whenever the obstruction can be negotiated; when the obstruction is complete nephrectomy is considered preferable to nephrostomy or any type of ureteral transplantation. Schmitz[19] comments that radiation treatment has apparently contributed to an increase in the frequency of urinary tract complications, but points out that the determination whether complications are due to the disease itself, or result from radiation, can be made only by routine examination of the urinary system in the first instance. Behney found the incidence of complications higher in his series of 166 autopsies. Drexler and Howes[20] state that encroachment on the ureter does not appear to occur any more frequently now than before the advent of X-ray and radium therapy, whereas Hunner expresses the opinion that radium probably causes ureteritis and peri-ureteritis. Lewis[21] states that cervical carcinoma may surround the ureter which, however, seldom becomes invaded by growth, even though practically obliterated by pressure from it. Hufnagl[22] states that in the absence of infection ureteral obstruction is due solely to increase in size of the primary growth, but when infection becomes superadded a true ureteral stricture results. Hertzer and Schreiner[23] conclude that the high percentage of ureteral strictures in advanced carcinoma of the cervix is due to pressure on the ureter from invasion of the parametrium or vesical wall, which possibly may be made worse as the result of fibrosis in the healing of these lesions. Matusovszky[24] also considers fibrotic healing processes in the parametrium to be causal. Graves and others support this opinion, stating that in patients cured of malignant stenosis of the ureters may result from fibrosis alone, either from infection or as a result of a replacement fibrosis following the regression of the tumour in that region. They are also of the opinion that

oedema following radiation may precipitate complete obstruction when marked partial obstruction already exists.

There are two main schools of thought, one considering the majority of obstructions to be due to the encroaching tumour, while the other considers radiation fibrosis to be the major factor. The consensus of opinion appears to be that vesical involvement is frequent from advancing malignancy, whereas the ureters are, if anything, more commonly involved in parametrial thickening and fibrosis, not necessarily malignant. Martin and Rogers[25] describe a small series of experiments which showed that with well-filtered radiation up to 2.5 erythema does not produce any serious change in the dog's ureter in 6 weeks; these findings suggest that the ureter is more resistant than either the bladder or the rectum, and will probably not be damaged when the broad ligaments are extensively treated with heavily filtered radiation. In a further series of experiments the same observers[26] show that by implantation of vanadium steel needles containing 6.25 milligrammes of radium alongside the ureter in 7 dogs for periods of 4 to 8 hours a dose of 71 milligramme hours or more will cause complete stricture of the ureter, and hydronephrosis within 2 weeks. However, comparable radiation of the ureter does not occur in any of the ordinary technique of treatment commonly employed.

From the practical point of view several writers make constructive suggestions. Everett[27] suggests cystoscopy and urography prior to treatment, and frequent ureteral dilatation after treatment, to enable us to determine the damage due to irradiation, and to prevent serious late effects in the form of stricture and hydronephrosis. Hunner also stresses the importance of recognizing late obstructions and the possibility of giving relief by ureteral dilatation. Martin[28] stresses the frequency and severity of pain in the loins, groins and hips due to malignant ureteral stricture, and advises ureteral dilatation to give relief of pain. Holzbach[29] advocates transplantation of the ureters into the upper portion of the bladder in advanced carcinomata as a prophylactic against later obstruction, pain and uraemia. Band and Wade[30] are also advocates of cystoscopic examination of cases of carcinoma of the cervix, and they discuss the advisability in certain cases of diverting the urinary stream to prolong life and diminish discomfort. Gemmell[31] approached the problem from a surgical standpoint and in a detailed report of his findings at cystoscopy and ureteral exploration prior to surgical removal of the growth, plus the actual

findings at the time of operation, he concluded that these procedures are of value in estimating the operability of a case. His paper includes a valuable description of the morphology and pathology of the various stages of vesical involvement by underlying carcinoma of the cervix. Among others Hartmann[32] and Forsdike[33] also stress the value of cystoscopic examination in the determination of operability of carcinoma of the cervix.

Vesical complications, *per se*, form a more or less distinct group. They may result from the advance of the disease itself or follow treatment. There are two main lesions encountered, namely fistulae and late radiation ulcers. Vesico-vaginal fistulae occur commonly in the later stages of untreated cervical carcinoma, and their incidence is not increased by radiation, in spite of the fact that a certain number of late radiation ulcers are associated with sloughing and fistula-formation. The limit of vesical tolerance has been estimated by Neef and Hoff[34] to be approximately 7,000 ' r ' in 4 weeks. This may produce bullous oedema and fibrinous desquamation, progressing to healing in 4 weeks (their article is illustrated by several very good colour photographs).

Post-irradiation ulceration of the bladder occurring between 1 and 2 years after radiation treatment of uterine cancer has been described by several authors. Dean[35] gives particulars of 3 cases and deduces that a total dosage of 3,500 millicurie-hours of radium applied to the uterus with normal filters should be considered as bordering on the upper limit of safety. He states: "Urologists probably will be called on to treat an increasing number of patients for this condition, in which the history, symptomatology, and cystoscopic appearance strongly suggest carcinoma of the bladder, but no tumour is present. If the approved methods of treating carcinoma should be employed in these cases, it is likely that the results would be disastrous."

Dean considers the differential diagnosis to be from neoplasm, Hunner's ulcer, and possibly tuberculous ulceration. He thinks a biopsy should always be performed. Smith[36] said that the inflammatory zone of oedema existing around the periphery of post-radiation ulcers is a striking diagnostic feature from cancer, which assumes the form of ulcerative or proliferative process with abrupt transition into normal mucous membrane. Stacy[37] also stresses the occurrence of delayed ulceration in the bladder many months after pelvic irradiation, and points out the difficulty of differentiating from extension of malignancy. Schmitz,[38] in the discussion on Stacy's paper, described a case of late chronic

radiation ulcer in the bladder occurring 9 years after treatment. Ward[39] advocates the use of a self-retaining catheter in the bladder while the radium is *in situ*—the collapsed bladder is more remote from the radium than the full bladder.

Several French authors describe thoroughly the physical signs associated with the various states of involvement of the bladder by advancing malignancy, and the effect of irradiation on the vesical mucosa. Gouverneur and Fabre[40] stress that vesical symptoms are not an accurate guide to the presence of involvement by underlying malignancy (*cf.* Gemmell). They describe 4 essential features of carcinomatous invasion: (1) bombement; (2) transverse ridging; (3) oedema, either diffuse or bullous; and (4) ulceration. They point out that the first three manifestations are not specific to malignant disease—they may be seen in some cases of adherent pyosalpinx. In their experience the prognosis, despite treatment, once ulceration has occurred, even in the absence of vesical symptoms, is extremely bad—all their patients dying in 4 to 7 months. Aman-Jean[41] states:

> Cystoscopic examination is in our opinion as useful as vaginal examination, and appears to us the most useful auxiliary diagnostic aid to the gynaecologist who is a cancerologist, without necessarily becoming a genito-urinary specialist. In effect cystoscopy permits:
>
> (i) Precise limitation of the spread of the malignancy.
>
> (ii) Observation of the effects of treatment and the sequelae, and early evidence of recurrence.

He remarks that haematuria in association with cervical cancer is indicative of actual ulceration of the vesical mucosa. Two essentials of cystoscopic examination are the condition of the trigone and that of the ureteric orifices. He divides the trigonal changes into two: (1) submucosal changes—bombement (distortion); mamelonnement sans sillon (small projections without ridging); mamelonnement avec sillon (projections with marked ridging)—not necessarily only transverse; and mamelonnement avec sillon et bourgeon ou ulceration cancereuse (addition of projecting growth ulcerating through). (2) Mucous changes—vascular congestion, granular cystitis, ecchymoses, and bullous oedema. Examination of the orifices shows three features: situation; form, i.e. morphology, whether normal, vulviforme, or punctiforme; and function. An immobile orifice without contractions or ejaculations is indicative of ureteral stenosis, which can be confirmed by intravenous injection of methylene-blue.

Radiation reactions are fairly strictly confined to the trigone,

and consist at first of a diffuse congestion; any presenting mucosal changes are temporarily exaggerated, and then after a few days subside and may disappear completely; any submucous changes tend to retrogress *ab initio*. Radio-necrotic ulceration is described as commonly found; the prognosis is for gradual healing to occur with gross scarring, or for a vesico-vaginal fistula to develop.

Cystoscopy following treatment shows: (1) Any late effects of radiation; (2) whether or not growth has completely resolved; (3) the occurrence of any recurrence.

During treatment cystoscopy is of particular value in diagnosis and treatment of intercurrent infections due to cystitis or pyelitis. In presence of bullous oedema or cystitis he advises twice daily wash-outs with warm antiseptic. When ureteral compression exists, he advises an indwelling catheter during irradiation. This is an interesting and most comprehensive paper.

Marzetti, V.,[42] concurs that among pre-radiation cystoscopic findings elevation of the vesical floor (so-called bombement) is the most frequent. Bullous oedema usually signifies invasion. Schmitz[43] states that bullous oedema is indicative of invasion of vesical wall and advises use of radium in such cases, but X-rays alone as a preliminary. Should the initial response be good, then radium can be added; if the response is not good (e.g. persistence of oedema), then it is inadvisable to push treatment if it is wished to avoid fistulae.

Dean[44] describes three well-recognized radiation reactions in the bladder: primary erythema occurring within 24 hours of radiation; secondary erythema occurring within 3 to 4 weeks after radiation, and sometimes associated with fibrinous exudation—symptoms of frequency and dysuria occur; and tertiary reaction, or delayed radium burn. The latter is the most important destructive effect of therapeutic doses of radium. It occurs on an average some 2 years after treatment; rarely it occurs within a year, and sometimes not for several years after treatment.

The symptoms of late radium ulceration are frequency, dysuria, and haematuria: the latter may be very profuse, and deaths from this cause have occurred. The cystoscopic appearances may closely simulate those of malignancy, and biopsy is essential for diagnosis—it is as important as in cases of radiation ulcer of the rectum to avoid further irradiation. The prognosis is on the whole good; vesico-vaginal fistulae may form or sudden haemorrhage may kill, but usually healing occurs, with formation of atrophic telangiectatic mucosa. Treatment by lavage, plus

instillations of 15 c.c. 10 per cent argyrol, is advocated. An important diagnostic feature from malignancy in the bladder is the absence of induration in the anterior vaginal wall.

Schugt[45] described a case treated for menorrhagia with 2 castration doses of X-rays and 1 of radium (1,748 milligramme-hours) with the occurrence of severe haematuria within 6 months of treatment. Cystoscopy showed telangiectatic varices of the bladder, which were treated by cystotomy and excision of the affected portions of the bladder. Schmitz[46] thinks that many cases of vesical ulcer must be associated with special lessening of resistance to gamma radiation (as postulated by some authors in connexion with rectal ulceration following irradiation), i.e. the patient has a true idiosyncrasy. Alternatively he admits faulty technique as a possible factor. He advises against local treatment of these ulcers, and thinks the best method of relief is by ureteric transplantation.

## Bladder Complications

In my experience vesical involvement occurs in three types of cases. First, it is found in advanced cases when cystoscopy is performed prior to treatment. Second, it occurs as a late phenomenon after treatment and is due to recurrent malignancy. Third, a specific post-radiation ulceration occasionally occurs.

In advanced carcinoma of the cervix, vesical involvement is relatively frequent because of the close juxtaposition of the base of the bladder to the cervix uteri. I have seen 110 cases of cervical carcinoma with signs of vesical involvement at their first attendance, while in a personal experience to date of over 1,000 cases of carcinoma of the cervix I have seen only 1 in which the growth was actually involving the rectum prior to treatment: the disparity is striking. The growth invades the muscle wall first, causing circulatory changes in the mucosa, then it spreads forwards into the mucosa, finally ulcerating through and progressing ultimately to a vesico-vaginal fistula. Except when the latter and obvious complication has occurred, diagnosis of involvement can be made only on cystoscopic examination, and vesical symptoms are quite valueless as a guide in this respect. The cystoscopic appearances of involvement are well described by Gemmell and Aman-Jean. Spread to the vesical wall produces first of all congestion and distortion of the mucosa. Further spread produces, in some instances, transverse ridging of the base—a series of transversely running hillocks. Isolated hillocks may occur. The next stage shows extensive bullous oedema, and this precedes

the final stage in which the growth ulcerated through the mucosa. From the point of view of staging the causes, I consider that ulceration alone or bullous oedema complicating ridging are indicative of a stage 4 growth in the League of Nations Classification.

Out of 195 patients who were grouped as stage 3 on clinical examination, no fewer than 44 showed involvement of the bladder on cystoscopy. In other words there may be an error of over 20 per cent on clinical staging, although in many of these involvement of the bladder was suspected and the need for cystoscopy before treatment was noted. This is a very strong argument for routine preliminary cystoscopy on all except early cases.

During treatment of cervical cancer with radium, the normal bladder does not show any marked change beyond a certain amount of injection of the basal mucosa. Very rarely an acute cystitis may apparently be precipitated by the treatment.

Following treatment either of two complications may occur: (1) recurrent malignant disease, or (2) post-radiation ulceration. Recurrent cancer shows the same lesion in the bladder as untreated cancer; there are no special features on cystoscopy. Post-radiation ulceration is a different entity. It is an uncommon but quite specific complication of radiation which appears to be more frequently encountered at other clinics.

In my experience it is relatively rare—during the past 5 years I have seen only 10 cases of late bladder reaction, and in only 4 of these did the reaction progress to ulceration: the other 6 presented merely an atrophic telangiectatic mucosa. This represents an incidence of approximately 1 per cent, and I doubt if it is appreciably higher, since every patient complaining of haematuria (the cardinal symptom) is forthwith cystoscoped.

The natural history of the condition is as follows: usually about 2 years or longer after radiation treatment the patient complains of an attack of haematuria which may, or may not, be accompanied by dysuria, and the passage of clots. Cystoscopy now reveals a bladder base with atrophic thin mucosa and numerous characteristic spider-web telangiectatic patches, one or other of which has caused the bleeding. The reaction may not progress any further and the haematuria cease spontaneously. Alternatively the condition may advance to actual ulceration. The four ulcers I have seen have all been situated immediately above the inter-ureteric bar. They have all had curious serpiginous heaped edges and a surrounding zone of bullous

oedema. The adjoining base mucosa is extremely blanched with scattered telangiectatic patches. The ulcer is usually occupied by a slough.

The diagnosis was made on the appearance of the ulcer and the absence of any definite malignant lesion. I did not make a biopsy for two reasons: (*a*) I feared that the trauma might lead to a vesico-vaginal fistula forming, and (*b*) on practical grounds little was to be gained, since if the ulceration was malignant further treatment should not be given, and if it was due to reaction spontaneous healing was the usual outcome. In 3 of my 4 cases the ulcer has healed spontaneously, leaving a rather scarred bladder base; the fourth patient unfortunately died of a sudden profuse haematuria some months after the initial symptoms had appeared: when admitted to hospital she was so exsanguinated that she was beyond aid.

Treatment of the haematuria is occasionally called for, and the best treatment is to cauterize the bleeding varices by cystoscopic diathermy. Clots may necessitate bladder wash-outs, but otherwise treatment is not called for once a diagnosis is made, since the natural tendency of the complication is towards spontaneous healing.

Vesico-vaginal fistulae are not infrequent terminal complications of the disease, but they may also result from radio-necrosis. Ulceration of the bladder base, just like ulceration of the rectum, may go on to complete destruction of the intervening tissues, though fortunately this is rare with our present techniques, and I can recall only two definite cases unassociated with recurrence. There is no treatment for the malignant cases. In the radio-necrotic type local repair is out of the question owing to the tissue non-vascularity and a diversion of the urinary stream is the only alternative. Colby expressed a general opinion when he stated that "It is a well-recognized fact that surgical attempts to close such fistulae are usually unsuccessful." However, Folsom and O'Brien[47] report a successful case of vaginal repair of a vesico-vaginal fistula occurring 6 months after radium treatment of carcinoma of the cervix. Eleven months after operation the patient was still well.

### Ureteral Complications

These are frequent and may be considered in three groups, namely in untreated cases, and in cases treated (*a*) surgically, and (*b*) by radiation.

My experience with ureteral complications following the surgical treatment of carcinoma of the cervix is very limited as I practically never perform Wertheim's hysterectomy. That such complications are not rare may be judged from the experience of Webb-Johnson.[48] He details a scheme of treatment for uretero-vaginal fistulae following hysterectomy and writes of a personal experience of 17 such cases. The only surgical complication I have met with was a uretero-abdominal fistula developing 5 years after a Wertheim's hysterectomy for carcinoma of the cervix. Following the operation the patient had had a urinary fistula from the lower end of the abdominal wound, but this had healed spontaneously in a few weeks. She was well for over 4 years, when a metastasis developed in the lower end of the wound and a urinary fistula reformed. Local radium implant was carried out, and 9 months later a supraclavicular metastasis occurred and was implanted with radium. The fistula persisted, and on further investigation it was found to be a left uretero-abdominal fistula. There was a large hydro-ureter and hydronephrosis above the site of leakage and bougies were passed through the cystoscope in an unsuccessful attempt to encourage spontaneous healing. Death occurred in a further 3 months, 1 year after the development of the fistula.

### Ureteral Involvements in Untreated Cases

There is an appreciable incidence of upper urinary tract complications due to pressure or invasion of the ureter in advanced cases of carcinoma of the cervix, and present at the first examination. During 1937 and 1938 a preliminary investigation either by intravenous urography or by ureteric catheterization was made in 90 cases with the following findings:

| Stage of disease | No. of cases | No. of complications | Hydronephrosis | | Sluggish function | No function |
|---|---|---|---|---|---|---|
| | | | Unilateral | Bilateral | | |
| 1 | 2 | 0 | | | | |
| 2 | 26 | 3 | 2 | 1 | — | — |
| 3 | 32 | 9 | 4* | 1 | 2 | 3* |
| 4 | 30 | 20 | 8* | 2 | 2* | 9 |

* Double lesion in one case.

Thus when unselected cases of stage 3 or 4 were investigated prior to treatment an incidence of nearly 50 per cent of upper

urinary tract complications were found. In the stage 4 cases such complications were nearly always present. A less reliable indication of a renal lesion was obtained from the blood-urea estimation. The average blood-urea in patients of the stage 3 cases with complications, in this series, was 40 mg. per cent (the highest being 56 mg. and the lowest 32 mg.) and in the stage 4 cases with complications, it was 58 mg. per cent (the highest being 225 mg. and the lowest 25 mg.); in both stages the amount is considerably higher than the normal, and suggests fairly considerable renal impairment.

## Effect on Prognosis

Analysis of the sequelae of the 32 patients showing an upper urinary tract complication prior to treatment would suggest that the presence of such complications makes worse the prognosis in no small measure. Of the 3 patients of stage 2 with initial lesions, 1 was dead within 3 months of treatment, while the other 2 are alive and well a full year after. Among the 9 patients of stage 3, 1 died in 2 months, 1 in 3 months, 1 in 6 months, 1 in 9 months, and 2 others are dying within a year of treatment. Four patients of stage 4 are alive at the time of writing, 2 being 10 months alive, 1 a year and a half, and 1 just 2 years. Three have known

Table Showing the Prognosis in Patients with Renal Lesion.

| Stage of disease | No. of cases | Alive over 1 year | Died within 1 year |
|---|---|---|---|
| 1 | 0 | — | — |
| 2 | 3 | 2 | 1 |
| 3 | 9 | 3, and 2 cases alive for 9 months with recurrences | 4 |
| 4 | 20 | 1 alive for 2 years and 2 for 10 months, but *all* have recurrences. One alive 18/12 with no obvious recurrence but vesico-vaginal fistula | 16 |
| Totals ... ... | 32 | 11 | 21 |

recurrence of cancer. The other 16 patients all died within 12 months of treatment, and 15 of them within 6 months. The duration of life in these patients was:

| | | | | |
|---|---|---|---|---|
| 11 months | ... | ... | ... | 1 case |
| 6 months | ... | ... | ... | 2 cases |
| 5 months | ... | ... | ... | 2 cases |
| 4 months | ... | ... | ... | 1 case |
| 3 months | ... | ... | ... | 4 cases |
| 2 months | ... | ... | ... | 3 cases |
| 1 month | ... | ... | ... | 3 cases |

TABLE SHOWING THE PROGNOSIS IN PATIENTS WITHOUT INITIAL RENAL LESION

| Stage of disease | No. of cases | Alive over 1 year | Died within 1 year |
|---|---|---|---|
| 1 | 2 | 2 | 0 |
| 2 | 23 | 13 | 10 |
| 3 | 23 | 11 | 12 |
| 4 | 10 | 1 | 9 |
| Totals ... ... | 58 | 27 | 31 |

In the 10 patients of stage 4 in whom there was not any involvement of the renal tract the prognosis is shown in the following table:

TABLE SHOWING THE PROGNOSIS IN STAGE 4 PATIENTS WITHOUT RENAL LESION.

| Case No. | Whether bladder involved or not | Alive | Died |
|---|---|---|---|
| 1 | Yes | | 3/12 |
| 2 | Yes | 18 months (7/1899) | |
| 3 | Yes | | 2 years |
| 4 | No | | 3/12 |
| 5 | Yes | | 9/12 |
| 6 | Yes | | 1 year |
| 7 | Yes | | 2 years |
| 8 | No | | 1 month |
| 9 | Yes | | 2 months |
| 10 | Yes | | 3 months |

Stated in terms of months the prognosis is slightly better in this group.

A glance at the above tables suffices to show that the prognosis is virtually hopeless in practically every case with initial involvement of the renal tract in which the local malignancy is of stage 3

or stage 4. This raises the question of the advisability of giving other than palliative treatment to such patients, or alternatively of considering the question of treatment of the renal lesion as a preliminary measure. In the majority of cases evidence of the exact cause of death has not been available, but in a high percentage it is known to have been uraemia.

### Surgical Treatment of the Renal Lesion

Surgical treatment has not been carried out before radiation in any case. In one case the development of acute pyelonephritis necessitated the interruption of radiotherapy while a nephrostomy was instituted. Treatment could not be completed, and this is the patient in stage 2 who died within the year. Suppression of urine in another patient some months after treatment also necessitated a nephrostomy. In another patient, too debilitated for nephrostomy, catheter drainage was established, and a ureterostomy was performed in a fourth patient with a vesico-vaginal fistula and but one functioning kidney. None of these patients lived more than a few weeks. Thus in my experience so far, the field of surgical intervention for this type of lesion is extremely limited in treated cases and is nil in cases prior to radiation.

### Ureteral Complications following Radiation Treatment

Involvement of the upper urinary tract is a not infrequent finding in patients investigated some months or years after treatment, but so far I am not able to state with any precision the rôle played by the various factors described by Howes and Strauss. To obtain scientific evidence about this subject calls for very painstaking and detailed investigations, and up to the present I have been endeavouring to approach the problem along the following lines:

(1) An unselected group of patients suffering from carcinoma of the cervix, mostly in stage 2 or stage 3, were examined cystoscopically through a Kelly direct vision cystoscope, and radio-opaque catheters were passed into the ureters. A stereoscopic X-ray was then taken after the radium applicators had been inserted, and from the films the physicist at the Holt Radium Institute, Mr. W. T. Meredith, was able to make an exact reconstruction in space of the position of the ureters relative to the radium units.

(N.B.—This work remains incomplete. The dose on parametrium in the near neighbourhood of the ureter can be calculated and details of this

have been published,[49] but the individual doses for the cases described have not been measured.)

(2) During 1937 and 1938 90 patients had the urinary function investigated prior to treatment. Of these, 32 had demonstrable lesions and 58 showed normal renal function. A careful follow-up of these 58 patients showed the following findings: 31 died within a year and in only 2 did any urological condition become recognized. Three patients had further uroselectan examinations 6 months after treatment without any obstruction being shown. The exact cause of death is unknown in the majority, and the autopsy was unobtainable except in 2 cases. In 27 of the patients still alive 13 were treated over a year ago, and 14 over 2 years ago: in none of these has any urological complication been recognized so far, but urological investigation has not been carried out since treatment.

(3) Study of autopsy material: I have investigated the post-mortem records of the last 30 patients dying of carcinoma of the cervix in the Christie Hospital, Manchester. These include those who died during treatment from septicaemia, peritonitis, or embolism, and they are in consequence not a representative selection. Patients in whom the disease is more advanced and in whom recurrent cancer and metastases occur mostly die elsewhere, and it is in this group that a much higher incidence of urological complications would be found. The following table illustrates the type and incidence of 13 renal lesions in this selected relatively early group of 30 cases:

| Lesion | No. of cases | Cause of death |
|---|---|---|
| Hydronephrosis | | (1) Embolism (cerebral) |
| | | (2) Septicaemia |
| | | (3) Uraemia |
| Unilateral | 6 | (4) Haemorrhage |
| | | (5) Haemorrhage |
| | | (6) Peritonitis |
| | | (1) Uraemia |
| Bilateral | 3 | (2) Metastases |
| | | (3) Uraemia |
| Pyonephrosis | | (1) Metastases |
| or | 4 | (2) Uraemia |
| Pyelonephritis | | (3) Uraemia |
| | | (4) Uraemia |

In the remaining 17 patients without mechanical renal lesion, 5 had renal lesions—2 with fatty degeneration, 1 with sub-acute nephritis, 1 with arterio-sclerotic nephritis, and 1 with infarcts.

Thus even in such an unrepresentative group of cases the incidence of renal lesions is over 50 per cent, and the majority are indubitably due to the uterine malignancy.

Unfortunately, in the majority of these cases, beyond noting that there was dilatation of one or both ureters but little attention was paid to the exact cause of ureteral obstruction. In only one case was uterine obstruction noted to have been due to actual invasion of the ureter by the growth, while in several it was noted to have been due to fibrous tissue involvement. Exact determination of this point is difficult in the majority of post-mortems on these patients, since the pelvic tissues are very distorted and it would be necessary to take serial sections after fixing the whole pelvis. It is undoubted that non-malignant stricture of the ureter can occur in a certain percentage of patients, but in the majority active malignancy is present in the parametrial tissues surrounding the ureter.

(4) In patients in whom the occurrence of some upper urinary tract lesion was suspected some time after treatment urological investigations were made, and in a number pathological conditions were found, unfortunately the lack of precise information as to the renal function in the first instance prevents many deductions being drawn in this group. Again, it is striking how poor is the prognosis in the presence of a renal lesion. Eighteen patients have had a uroselectan examination in the course of investigation of the aetiology of severe pain subsequent to treatment. Fifteen had a renal lesion, either no function of a kidney or hydronephrosis. In 12 the renal lesion was associated with a parametrial high dose effect that was probably causative on some, if not all, of the ureteral obstructions. The prognosis in the whole series was extremely poor once a renal lesion had developed.

Case 1. Mrs. H. A. She was a stage 4 carcinoma of the cervix seen first in June 1937. *Inter alia* she had frequency and right loin pain. The right kidney was enlarged and easily palpable. Intravenous urography showed the right kidney low in position and hydronephrotic, and poor functioning of the left kidney. The blood-urea was 31 mg. per cent. Cystoscopy showed diffuse bulging and oedema of the base, with obstruction to bougie at 2 cm. up the right ureter. Two months later, after completion of full course of radium and X-ray treatment, further cystoscopy was performed because of persistence of pain and frequency, and now it was impossible to pass a bougie up the left ureter, though difficulty was not

found on the right side. The right ureter was seen to function, but not the left. Indigo-carmine did not appear in the bladder in ½-hour after injection. The blood-urea was now 104 mg., and the urine was heavily infected. The patient died of uraemia within 6 months of treatment.

CASE 2. MRS. F. E. She had a stage 2 carcinoma and was cystoscoped because of marked frequency. There was some trigonitis, and a bougie was obstructed at 2 cm. on the right side. Uroselectan showed gross hydronephrosis on that side. Blood-urea was 56 mg. per cent. There was thus considerable renal damage in a relatively early carcinoma of the cervix. Following a single radium insertion the hydronephrosis became infected, and nephrostomy was required. She died of this complication within 3 months of her first attendance.

CASE 3. MRS. A. L. Was first seen in December 1936, when she was found to have a stage 4 carcinoma because of widespread vesical involvement, as seen on cystoscopy. She was given a preliminary radium treatment and 3 months later a further cystoscopy done—this showed marked improvement in the condition of the bladder. Both ureters were patent and did not present any difficulty on bougie examination. Unfortunately urography was not performed at this time. A full course of X-ray and radium treatment was given in April and May 1937, and at the end of treatment a further cystoscopic examination was made. On this occasion the bougie introduced into the right ureter was firmly gripped just beyond the bladder. Urography did not demonstrate any activity in the right kidney, but normal functioning in the left one. Three months later (August 1937) a further uroselectan showed functioning of the right kidney now, though somewhat impaired. The investigations suggest a temporary suppression of function in the right kidney, precipitated by treatment and associated with an obstruction of the pelvic ureter—a subsequent cystoscopy one year after treatment showed that this obstruction had disappeared and uroselectan disclosed normal function of both kidneys.

CASE 4. MRS. F. H. This patient was treated with X-rays and radium in June and July 1934, for a stage 2 carcinoma. Preliminary urinary tract investigations were not made. One year later she developed pain in the right renal region and cystoscopy was performed in September 1935. The right ureter was found to be obstructed 8 in. from the bladder. Uroselectan disclosed complete non-functioning of right kidney with blockage of the right ureter just below the kidney. The kidney was palpable. Nephrectomy was decided upon in view of the patient's discomfort, and was carried out by Mr. Macalpine in September 1935. The whole of the upper two-thirds was infiltrated with tumour, which on microscopy proved to be squamous epithelioma, similar to the original primary cervical growth. (Metastasis to the kidney is a very rare manifestation in cervical carcinoma. A case was reported to the North of England Obstetrical Society in 1936.)

CASE 5. MRS. E. J. Stage 3 carcinoma treated in March and April 1937

with X-rays and radium. Investigation of urinary tract prior to and during treatment did not show any abnormality. Three months after treatment developed severe pain in left loin and back. On cystoscopy left ureteric orifice was golf-hole and bougie was obstructed at 2 cm. Uroselectan revealed hydronephrosis on the left side, with obstruction of the ureter at the level of the sacro-iliac joint. Mr. Watkins cystoscoped her bladder and found it possible to introduce a No. 5 olivary catheter past the obstruction. He diagnosed a tubular stricture some 4 inches long. The stricture was dilated, and there was appreciable relief of pain for a few days, when it recurred. On opening the abdomen the left ureter was found to be constricted from the pelvic brim to the bladder by a firm mass. The ureter was blunt-dissected free with difficulty, presacral neurectomy was performed, and an aortic gland removed for section—it proved to be malignant. Leakage occurred from the freed ureter, and the patient died in 4 days. Histological examination of the compressing parametrial tissue did not reveal any malignancy—it was purely organizing reactive fibrous tissue.

Case 6. Mrs. M. G. Stage 4 carcinoma (on bladder involvement) treated with radium and X-rays October/December 1937. Bladder involved at first treatment, but no obstruction in either ureter, and renal function (urography) normal. Cystoscopy just prior to termination of treatment revealed some obstruction to passage of bougie on left side. Six weeks later this obstruction was complete. Uroselectan now showed absence of function on left side. Six months later patient died of pulmonary embolus, but there was unquestionably widespread recurrent malignancy in the pelvis.

## References


1. Beatty, T. *Dublin Quart. Journ. Med.*, 1854, xvii, 443.
2. Wagner, E. *Der Gebarmutterkrebs.* Leipzig, 1858.
3. Winter. *Zeitschr. für Geburtsh. u. Gynäkol.*, 1893, xxvii, 101.
4. Williams, W. R. *Brit. Gynaec. Journ.*, 1895, xi, 529.
5. Macalpine, J. B. "Cystoscopy and Urography," 2nd Edit. (Bristol, 1936).
6. Warren, S. *Archives of Pathology*, 1931, xii, 783.
7. Faerber, H. *Zeitschr. für Geburtsh. u. Gynäkol.*, 1931, xcix, 213.
8. Behney, G. A. *Amer. Journ. Obstet. and Gynecol.*, 1933, xxvi, 608.
9. Holzbach, E. *Zentralbl. für Gynäkol.*, 1923, xlvii, 1893.
10. Pearson, B. *Amer. Journ. Cancer*, 1936, xxviii, 31.
11. Ewing, J. "Neoplastic Diseases," 2nd Edit. (Phila., 1922).
12. Hunner, G. L. *Amer. Journ. Obstet. and Gynecol.*, 1934, xxviii, 10.
13. Graves, R. C., C. J. E. Kickham, and I. T. Nathanson. *Journ. Urol.*, 1936, xxxvi, 618.
14. *Idem. Surg., Gynecol. and Obstet.*, 1936, lxiii, 785.
15. Pomeroy, L. A. *Amer. Journ. Roentgenol.*, 1939, xli, 73.
16. Colby, F. H. *New Eng. Journ. Med.*, 1933, ccix, 231.
17. Bugbee, H. G. *Journ. Urol.*, xxxii, 439.

17a. *Idem. Journ. Mount Sinai Hospital*, 1937-38, iv, 712.

18. Howes, W. E., and H. Strauss. *Amer. Journ. Roentgenol.*, 1939, xli, 63.

19. Schmitz, H. *Amer. Journ. Roentgenol.*, 1930, xxiv, 47.
20. Drexler, L. S., and W. E. Howes. *Amer. Journ. Obstet. and Gynecol.*, 1934, xxviii, 197.
21. Lewis, E. C. *Brit. Journ. Urol.*, 1936, viii, 139.
22. Hufnagl, K. *Zeitschr. für Urol. Chir.*, 1934, xxxix, 7.
23. Hertzer, C. C., and B. F. Schreiner. *Surg., Gynecol. and Obstet.*, 1926, xliii, 470.
24. Matusovszky, A. *Monatschr. für Geburtsh. u. Gynäkol.*, 1923-4, lxv, 299.
25. Martin, C. L., and F. T. Rogers. *Amer. Journ. Roentgenol.*, 1926, xv, 336.
26. *Idem. Amer. Journ. Roentgenol.*, 1926, xvi, 215.
27. Everett, H. S. *Amer. Journ. Obstet. and Gynecol.*, 1934, xxviii, 1.
28. Martin, C. L. *Amer. Journ. Roentgenol.*, xx, 30.
29. Holzbach, E. *Zentralbl. für Gynäkol.*, 1923, xlvii, 1893.
30. Band, D., and H. Wade. *Trans. Edin. Obstet. Soc.*, 1931, li, 89.
31. Gemmell, A. A. *Journ. Obstet. and Gynecol.*, 1928, xxxv, 3.
32. Hartmann, N. *Paris. Med.*, 1913, ix, 523.
33. Forsdike, S. *Brit. Med. Journ.*, 1924, ii, 94.
34. Neef, Th. C., and Hoff, F. *Strahlentherapie*, 1939, lxiv, 113.
35. Dean, A. L. *Journ. Amer. Med. Assoc.*, 1927, lxxxix, 1121.
36. Smith, G. C. *Journ. Amer. Med. Assoc.*, 1927, lxxxix, 1123.
37. Stacy, L. J. *Amer. Journ. Roentgenol.*, 1928, xix, 323.
38. Schmitz, H. *Amer. Journ. Roentgenol.*, 1928, xix, 328.
39. Ward, G. C. *Amer. Journ. Obstet. and Gynecol.*, 1933, xxv, 1.
40. Gouverneur, R., and S. Fabre. *Gynécologie et Obstétrique*, 1925, xi, 189.
41. Aman-Jean, F. *Bull. du Cancer*, 1933, xxii, 556.
42. Marzetti, V. *Clin. Obstet.*, 1926, xxviii, 350.
43. Schmitz, H. *Amer. Journ. Roentgenol.*, 1930, xxiv, 47.
44. Dean, A. L. *Amer. Journ. Obstet. and Gynecol.*, 1933, xxv, 667.
45. Schugt, P. *Zentralbl. für Gynäkol.*, 1923, xlvii, 1862.
46. Schmitz, H. *Amer. Journ. Roentgenol.*, 1930, xxiv, 47.
47. Folsom, A. I., and R. A. O'Brien. *Texas State Journ. Med.*, 1938, xxxi, 476.
48. Webb-Johnson, A. *The Lancet*, 1935, I, 1083.
49. Tod, M. C., and W. T. Meredith. "A Dosage System for use in the treatment of Cancer of the Uterine Cervix," *Brit. J. Radiol.*, xi, New Series, No. 132, Dec. 1938.

# The Foetal Abnormalities that cause Difficult Labour

BY

B. H. SHEARES, L.M.S. (Singapore)

*The Maternity Hospital, Kandang Kerbau, Singapore*
*Straits Settlements*

THIS paper is a review of foetal abnormalities, particularly those causing dystocia; it covers the experience gained in 88 cases, of which 48 caused difficult labour, and contains a description of the various types encountered together with the usual history elicited, and the treatment carried out.

An abnormal foetus which causes difficult labour is rare, even in a maternity hospital. Though the treatment is often simple there is real danger to the mother when the condition is unrecognized and the foetus is forcibly extracted with the possibility of rupturing the uterus; while, had it been recognized, consideration would not have been given to the foetus, whose life in most cases is valueless, and it would have been removed by a destructive operation, or even piece-meal, without danger of injury to the mother.

Abnormality of the foetus may be suspected antenatally if there is hydramnios, and this complication was present in 45 per cent of the cases in my review, but when a labour is obstructed the obstetrician should endeavour to ascertain whether the cause is due to abnormality of the uterus, the pelvis, or the foetus. He may have some indication as to the probability of abnormality of the foetus when such conditions as hare-lip, cleft palate, atresia ani, or spina bifida, are observed in that portion of the foetus presenting or already born, as occurred in 17 per cent of my cases.

I invariably suspect the presence of a foetal abnormality when, with the os fully dilated and the pelvis normal, a little more than the usual amount of traction on the foetus fails to move it, or when there is arrest after the head or breech is born.

The possible types of foetal abnormalities which might cause difficult labour are enumerated, but detailed discussion is confined to those types met with in this series.

## Possible Types of Foetal Abnormalities

(*a*) General enlargement of the foetus.
1. Abnormal size of a developmentally normal foetus.
2. Hydrops foetalis.

(*b*) Local enlargement of the foetus.
1. Head: Hydrocephalus, deformities of the cranium, achondroplasia, iniencephalus, encephalocele, epignathus.
2. Neck: "Intra-uterine or congenital bronchocle" tumours.
3. Shoulders: Large shoulder-girdle; tumours.
4. Thorax: Hydrothorax; tumours.
5. Abdomen: Ascites, distended bladder; tumours of kidney, spleen or liver.
6. Pelvis: Large pelvis; tumours.

(*c*) Conjoined twins and double monsters.

*Abnormal Size of a Developmentally Normal Foetus.*

This group should properly be considered under the heading "disproportion," but it is considered that a large baby causing dystocia should be included in the subject under discussion, provided the uterine forces and the pelvic architecture are normal, and especially if the previous labours were normal, because the baby is abnormal for the patient concerned.

Heredity is cited as a cause for an abnormally large foetus, but in only 2 of my cases was this association probable owing to the large stature of the fathers.

In a primipara an abnormally large foetus is nearly always diagnosed because there is almost invariably some disproportion which is recognizable. The patient is given a trial labour which ends in Caesarean section, difficult delivery by the forceps or craniotomy depending on how much the obstetrician has erred in his judgment. In my experience the greatest difficulty in diagnosing an abnormally large foetus is in a multipara whose babies tend to increase in size with each successive pregnancy, without causing difficult labours, until a baby is just too big to pass through the pelvis. A careful enquiry into such a case often reveals a history of post-maturity and discomfort or dyspnoea, not so pronounced in the earlier pregnancies. The uterus will be noticed to be abnormally large and sometimes pendulous, but the relatively large head above the brim and the inability to recognize the second head on palpation should

exclude a diagnosis of twins, but if there is any doubt an X-ray should be taken. The labour is usually complicated by early rupture of the membranes and sometimes by inertia due to over-distension of the uterus, and I attach considerable importance to the former in a multipara, if the uterus is large and twins have been excluded, and always make an examination *per vaginam* to discover whether signs of disproportion or post-maturity are present, such as the stony hardness of the head, the narrow sagittal suture, and the relatively small fontanelles, suggesting that the head cannot easily be moulded.

Not one of the 19 cases in my series had been seen antenatally and all the babies weighed over 8 pounds 14 ounces, the heaviest being 11 pounds 6 ounces.

Two mothers were primiparae who were admitted in an advanced 2nd stage of labour; and the foetus in one case was stillborn after delivery by the forceps, while in the other craniotomy was performed to effect delivery.

The remaining 17 cases occurred in multiparae who had histories of previous normal deliveries, and of these 8 gave histories of post-maturity. The foetal head presented in 12 of these cases and delivery was effected by the forceps in all but 2 on which craniotomy had to be performed; the face presented in one case which was delivered by the forceps, and in the remaining 4 breech cases delivery of the after-coming head had to be assisted by the forceps. These 4 babies were all over 9 pounds 8 ounces in weight. Of the 12 vertex presentations it was necessary in 2 to carry out craniotomy. Ten were delivered with difficulty by the mid-forceps operation, and 3 were complicated by persistent occipito-posterior position. There was one death in this series from sepsis and general peritonitis.

*The True Foetal Abnormalities.*

The other foetal abnormalities to be discussed may be considered true abnormalities in that there is some mal-development of the ovum with alteration of some of the physical characters of the foetus. Sixty-nine such abnormalities were encountered in this series in which hydramnios was the most common complication of the foetal abnormalities, being present in 59 per cent of the cases.

The associated malformations of the foetus as, for example, cleft palate or spina bifida occurred in 21 per cent of this series, and no foetus weighing less than 5 pounds caused dystocia.

*Hydramnios.* This is commonly associated with morbid foetal conditions, and it suggests by its presence one or other of these states, but at the same time it must be remembered that it may occur when neither the foetus nor the mother shows any signs of a pathological process. It is very frequent in connexion with the manifestations of embryonic and germinal pathology for it is found associated with all kinds of monstrosities and malformations, and with multiple foetûs, and is found in grave maternal states such as albuminuria. It is often easy to diagnose hydramnios but, having diagnosed it, one ought immediately to suspect a morbid state of the unborn infant. Hydramnios has not, properly speaking, any pathological anatomy as even the origin of the liquor amnii in normal pregnancies is a matter of uncertainty. The positive Wassermann reaction obtained in many cases of hydramnios is not, I think, merely incidental, though several authorities aver that syphilis is not a cause.

(*a*) *General Enlargement of the Foetus.*

*Hydrops Foetalis.* This is a morbid condition of the foetus characterized by general anasarca, by the presence of fluid effusions in the peritoneal, pleural and pericardial sacs, and usually by oedema of the placenta, resulting in the death of the foetus before, during, or shortly after birth, which is often premature. The large size of the baby causes difficult labour.

The only case in this series weighed 9 pounds 6 ounces, not including the weight of the fluid removed from the thorax and abdomen. The patient was admitted with the head half out of the vagina, and she gave a history of excess of liquor amnii at the time the membranes ruptured. The diagnosis was not difficult in this case as that portion of the face visible at the vulval orifice was extremely oedematous. The shoulders of this foetus were impacted and necessitated cleidotomy, but this operation did not make the extraction easier, and it was necessary to perforate the thorax with Simpson's perforator permitting the escape of several ounces of serous fluid followed by perforation through the diaphragm into the peritoneal cavity and the release of a large quantity of straw-coloured ascitic fluid, after which the foetus was extracted with ease.

The expression of the placenta is usually difficult in a case of hydrops foetalis, and this case was no exception, but after great difficulty the placenta was delivered by the Crede method; it was large and oedematous and weighed 3 pounds. The

mother did not suffer any subsequent haemorrhage and the puerperium was normal.

A cursory examination revealed that the foetus was achondroplastic and was markedly oedematous and pale. There was marked chemosis and some fluid in the pericardium and scrotum. The foetus was sent to the Anatomical Department, College of Medicine, for dissection, but unfortunately decomposition precluded detailed study of the specimen.

(*b*) *Local Enlargement of the Foetus.*

(1) *Head.* The head of the foetus needs most consideration from the point of view of obstetrics, and any abnormality in the size or shape is sure to cause dystocia. All the abnormal foetûs which cause dystocia entirely on account of abnormality of the head are classified in this group.

(*a*) *Hydrocephalus.* Hydrocephalus consists essentially in the presence of a fluid accumulating inside the cranium, generally within the distended ventricles and their communicating passages, but occasionally between the membranes. The pathology and pathogenesis is as yet unexplained, but syphilis or alcoholism of the parents are considered contributory causes.

In this series only 2 cases had a positive Wassermann reaction, and in none had there been a history of alcoholism.

There are two theories regarding the pathogenesis—foetal disease and embryonic malformation—and neither of them has been conclusively proved.

There were 29 cases of my series in this group, of which 8 were primiparae and 18 were complicated by a history or signs of hydramnios. Twenty-one of the foetûs weighed more than 5 pounds, the average being 7 pounds, with dystocia requiring perforation of the head in 12 cases.

The vertex presented in 14 cases and 13 presented by the breech, while 2 were transverse, in both of which version was done and perforation was necessary in one case.

Two of the cases in this group were complicated by eclampsia and one by placenta praevia, and the only death occurred in one of the former.

Hydrocephalus has been found to be the easiest of the foetal abnormalities to diagnose, especially in labour. The large unfixed head in a vertex presentation, hydramnios, and on examination *per vaginam* the semicystic or cystic head with its wide sutures and large fontanelles are easily recognized. In

a breech presentation diagnosis is not so easy, but suspicion is raised when there is difficulty with the after-coming head when the trunk and limbs have been delivered without difficulty, and the pelvis has been found to be of normal architecture. The large head sitting on the brim and grossly over-riding it confirms the diagnosis and, if the head is large enough to cause obstruction, perforation of the head is the treatment. Perforation of the on-coming head, in a vertex presentation, presents no difficulty with Simpson's perforator, but it is advisable to perforate through a bony part of the head, as an opening made over one of the fontanelles or sutures is liable to close over and thus impede escape of all the cerebro-spinal fluid. Perforation of the after-coming head is not so easy because of the difficulty in reaching up to the head. The perforator is guided by the fingers of the left hand, avoiding injury to the uterus, and the occiput can be perforated without difficulty; rarely, it is easier to perforate through the mouth and hard palate, and once the cerebro-spinal fluid has escaped the cranium collapses and delivery can be completed with ease.

(*b*) *Cranial deformities.* Dolichocephalus, brachycephalus, oxycephalus. These conditions result from premature closure of one or several of the sutures of the head. They are not always antenatal in origin but some, especially dolichocephaly or long head, resulting from synostosis of the sagittal suture, do occur before birth.

Dolichocephaly is divided into several types:

(1) Sphenocephaly—wedge-shape, due to compensatory enlargement in the region of the anterior fontanelle, the sagittal suture being ossified.

(2) Leptocephaly—narrow-shape, due to synostosis of frontal and spenoid.

(3) Clinocephaly—saddle-shape, due to synostosis of parietals with sphenoidal great wing or with the squamous temporals.

(4) Scaphocephaly—boat-shaped, long and narrow, and the region of the sagittal suture is raised to a keel.

The rarer types of cranial deformities are:

Brachycephaly—short-head, due to early closure of the transverse sutures.

Oxycephaly—sugar-loaf head, synostosis between the parietals and the occipital and compensatory growth of the anterior fontanelle.

All these types of cranial abnormalities are extremely difficult to diagnose even when labour is advanced and the only

case encountered in this group was that of dolichocephaly belonging to the sphenocephaly sub-group.

The patient was a multipara admitted in the 2nd stage of labour with the brow presenting, and foetal heart audible. An endeavour to flex the head before applying the forceps was made but this failed because it was jammed in the middle strait of the pelvis. The forceps was, therefore, applied and it locked fairly well and traction was tried tentatively; the head advanced and the foetus, 6 pounds in weight, was delivered stillborn. The head was definitely wedge-shaped with enlargement in the region of the frontal bone, and the sagittal suture was hardly discernible. The patient made an uneventful recovery.

(*c*) *Achondroplasia, chondrodystrophia foetalis or micromyelia.*

Although this condition is a disturbance of bone growth during intra-uterine life in which there is interference with endochondral ossification, especially at the ends of long bones, I am including it under the heading "enlargement of the head" for the reason that, from an obstetrician's point of view, it is only the abnormality of the head that causes dystocia.

The aetiology has not been definitely established but various theories have been advanced, and like many other congenital bone conditions it was at one time regarded as foetal rickets, but this suggestion, being without foundation in fact, is now only of historical interest. Neither tuberculosis nor syphilis is a causative factor, but the ductless glands in general, and the pituitary in particular, have not escaped blame as the cause of the disorder, and all investigators are agreed that it is a general disturbance of the endochondral ossification. In 1893 Kaufmann gave it the name of chondrodystrophia foetalis because there is a "malnutrition of the cartilage rather than an absence of the cartilage."

The physical characteristics of an achondroplastic infant are well known and I will only describe briefly the head. The measurements of the head of the three non-hydrocephalics of five specimens averaged: Sub-occipito-bregmatic, 10.5 cm.; sub-mento-bregmatic, 11.1 cm.; occipito-mental, 11.5 cm.; bi-temporal, 10 cm.; bi-parietal, 10.5 cm.; occipito-frontal, 11.2 cm.; circumference (sub-occipito-bregmatic), 28.7 cm.; and these measurements are relatively and absolutely larger than those of the head of a normal foetus at term.

The head is rounder than normal and markedly brachycephalic; the face is broad and at the root of the short nose

is a characteristic depression or indentation. The portion of the skull developed in cartilage—the base—is grossly abnormal and instead of the usual centres of ossification of the pre- and post-sphenoid and the basi-occiput, there is an irregular synostosis of the individual centres. This abnormality was noted in 3 of the specimens, while in the other two there was a definite line of separation between the basi-occiput and the pre- and post-sphenoid as proved by the point of a scalpel and by X-rays. This anomalous separation in the 2 cases was due to complication by hydrocephalus, which, in a mild form, is common in achondroplasia.

In consequence of the synostosis, the growth of the skull is retarded and it remains short while the remainder of the skull grows normally. The vault becomes more globular in form and is expanded to make room for the developing brain since little or no contribution to the available intra-cranial space is made by the base, and the fontanelles are, therefore, relatively large. The smallness of the base of the skull is responsible for the marked depression at the root of the nose, and for the flattening of the face. Achondroplasia is sometimes associated with foetal dropsy and hydramnios and both of these conditions complicated 2 of the cases.

The 5 cases of achondroplasia all weighed over 5 pounds, and all caused difficult labour as none of them had been diagnosed antenatally. One occurred in a primipara. Three presented by the vertex, and the 2nd stage of labour was long in each of these cases, of which one required craniotomy to effect delivery, and difficulty with the birth of the shoulders in another case owing to impaction. Of the remaining 2 cases, one was a brow presentation requiring perforation of the head, the other presented by the breech and the forceps was required to deliver the after-coming head. All were stillborn.

(*d*) *Iniencephalus.*

This type of abnormality is extremely rare, and only one case has been met, and fortunately in this the labour was premature and the foetus weighed only $2\frac{1}{2}$ pounds. Pregnancy had been complicated by hydramnios.

This abnormality, which at term might cause extreme dystocia, must be grouped in the class of rachischisis, or fissuring of the spinal column. Generally there is present an occipital encephalocele or a spina bifida with protrusion of the spinal meninges. The deformity consists of three cardinal features,

namely, a backward displacement of the head and a posterior bending of the spinal column which have given to the condition the term "retroflexion of the foetus"; a varying degree of spina bifida affecting the upper spine; and a defect of the posterior portion of the skull in the region of the foramen magnum. The specimen on dissection and X-ray examination presented all the three cardinal features; the spina bifida affected the upper 6 cervical vertebrae.

(*e*) *Encephalocele.*

This condition is a protrusion of part of the cranial contents through a more or less rounded opening in the cranium; the swelling produced is covered by skin. The tumour varies in size and shape and may consist of cerebellum or cerebrum, cerebro-spinal fluid and the cranial membranes (encephalocele) or merely cerebro-spinal fluid and membranes (meningocele). It occurs most commonly in the posterior part of the cranium, the occipital encephalocele; the next common position is the anterior part (sincipital encephalocele). The following associated foetal malformations are common—spina bifida, hydrocephalus, hare-lip, club-foot, exomphalos, ectopia vesicae, transposition of the viscera, amniotic adhesions and cystic kidney.

There were 2 such cases in this series—one was premature, weighed 1½ pounds and caused no difficulty. The other was admitted after unsuccessful efforts at delivery had been made and was in an extremely poor condition, the perineum had been completely torn and the head was half-born. Anti-collapse measures were resorted to, and when the mother had rallied to some extent an examination *per vaginam* was made and a mass, attached to the occipital region of the head by a short pedicle, was found and a portion of omentum of the mother was lying in the vagina. It was not possible to cut across the pedicle owing to lack of working space as the head and the tumour were jammed in the vagina. The head was, therefore, perforated, the brain removed, and by means of a strong pair of scissors, as much of the head as possible and part of the semi-solid tumour was cut away, piece-meal, when it was possible to extract the foetus. The placenta was removed manually and the rent in the uterus plugged with gauze, but the patient died about 2 hours after the operation.

The foetus, together with the pieces of tumour and head, weighed 9½ pounds. The specimen was too damaged for detailed examination but it appeared to be the size of a tan-

gerine orange, was semi-solid, covered by skin and contained caseous material which looked like brain tissue mixed with membrane and connected through a rounded opening near the occipital protuberance with the cranial cavity.

*Epignathus*. This is a monstrosity, and should really be considered under the last group in the classification, but it is more convenient to mention it here as it causes dystocia owing to abnormality of the head of the foetus. It belongs to the group of unequal and asymmetrical monsters and is a teratomatous parasite attached to the jaw bone of the autosite or host from whose mouth projects a mass of tissue springing usually from the region of the base of the skull.

I have met with one case, and this did not cause difficulty, but unfortunately was too macerated for detailed anatomical study. The delivery was premature, the foetus presented by the vertex and weighed 2 pounds. The patient came into hospital in the 1st stage of labour with the membranes already ruptured with a history of excess of liquor amnii at the time of rupture. The irregular parasite consisted of portions of cartilage and unidentifiable macerated tissue which protruded from the mouth of the foetus and seemed to originate from the base of the skull.

(2) *Neck*. "Intra-uterine or congenital bronchocele." These terms have been made to include not only enlargements of the thyroid gland and parathyroids, but also cervical hygromata, cervical spina bifida and ranula. In Malaya, where goitre is not endemic, a foetal tumour of the front of the neck is almost invariably a hygroma which varies in size from that of a hen's egg to that of a foetal head. The 3 cases met were all hygromata and the infants were born alive and weighed 8 pounds 4 ounces, 6 pounds 8 ounces, and 7 pounds respectively. Two presented by the vertex, and delivery was easy as the tumours were the size of hen's eggs in both cases. The third case presented by the breech and delivery of the head was somewhat difficult as the tumour was the size of a mandarin orange.

(3) *Shoulders*. Congenital tumours of the shoulders are mentioned in the literature, but no case causing dystocia has been described.

*Large shoulder-girdle*. A foetus with a disproportionately large shoulder-girdle as the only abnormality is rare but an anencephalus usually has an abnormally broad shoulder-girdle, and 15 cases of labour complicated by anencephalic infants have been seen. Hydramnios, which, as already stated, is a common

complication, occurred in 12 of these cases while 5 had spina bifida.

The heaviest foetus weighed $7\frac{1}{2}$ pounds and this was a face presentation necessitating resort to cleidotomy in order to deliver the shoulders. Seven of the remaining cases weighed more than 5 pounds and 12 presented by the head or face equally, while 3 were breech presentations.

Besides the above-mentioned case requiring cleidotomy there were 4 other cases in which real difficulty was experienced in the delivery of the shoulders and in which the usual expedients of hooking the posterior axilla with the index finger or bringing down the posterior arm failed to effect delivery. One was the case of hydrops foetalis already mentioned, when a cleidotomy operation had to be done, one was a case of achondroplasia when it was necessary to resort to the breech-hook, and the other 2 cases were in abnormally large babies, each weighing over 9 pounds, and the blunt breech-hook over the posterior axilla was used as a tractor, resulting in both babies being born alive and uninjured. They appeared to have abnormally broad shoulders, but unfortunately the comparative measurements of the shoulder girdle and the trunk and limbs were not recorded.

(4) *Thorax.* Enlargement of the thorax is almost invariably due to hydrothorax which is concomitant with collection of fluid in the other serous cavities. Hydrothorax is seldom serious enough to cause dystocia because the cavity is caged in the ribs which are not easily distended. Difficulty was experienced in only one case, namely the case of hydrops foetalis, when the thorax was perforated because it was distended to a degree which prevented one reaching up to the ascitic abdomen of the foetus.

Enlargement of the thorax due to a tumour of the thymus is mentioned in the literature but a case of dystocia ascribed to this cause has not been described.

(5) *Abdomen.* The enlargement of the abdomen which might cause dystocia is foetal ascites but other abdominal tumours are mentioned as possible causes, especially a distended foetal bladder, tumours of the kidney, spleen and liver, but although several infants with these conditions have been seen, dystocia has not been occasioned.

*Foetal ascites.*

This is an effusion of fluid into the peritoneal cavity, with consequent abdominal distension, and is due to several different

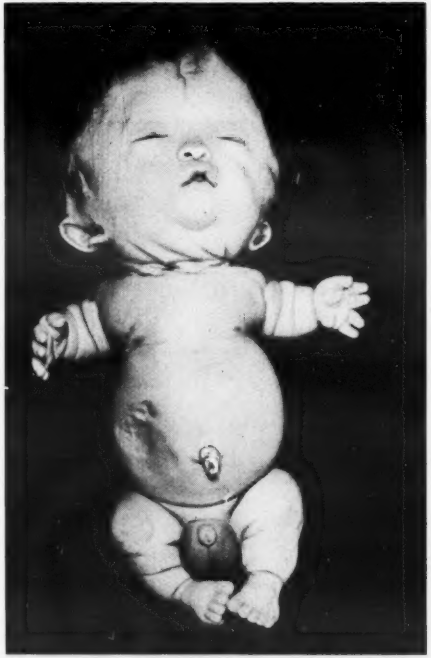


FIG. 1.

Showing an achondroplastic monster with hydrocephalus.
The head has been perforated.

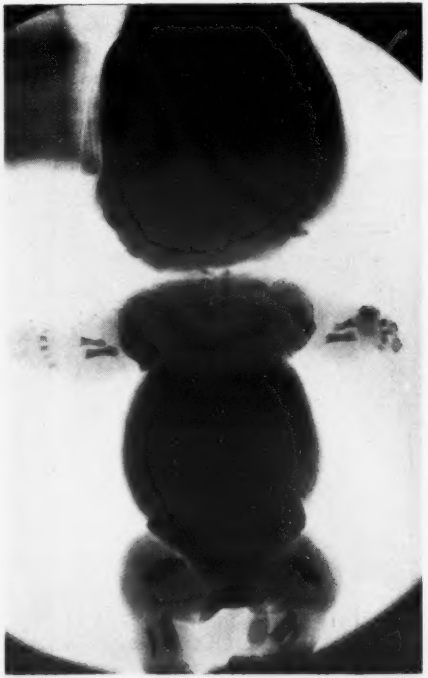


FIG. 2.

X-ray picture of Fig. 1 showing the characteristics of the long bones.

FIG. 3.

X-ray picture (side view) of Fig. 1, showing separation of the centres of ossification of the pre- and post-sphenoidal great wings and the basi-occiput. This anomaly is due to hydrocephalus which complicated the specimen.

FIG. 4.

Showing another achondroplastic monster. The head has been perforated and there was some degree of hydrocephalus.

FIG. 5.

X-ray picture of Fig. 4 showing the typical shortening of the long bones and the separation of the centres of ossification of the base of the skull because of some degree of hydrocephalus.

FIG. 6.

Front view of iniencephalus.

FIG. 7.

Lateral view of Fig. 6 showing the dorsiflexion and the encephalocele.

FIG. 8.

X-ray picture of Fig. 7 showing the dorsiflexion of the cervical vertebrae, which are bifid, and the hiatus in the occipital bone communicating with the foramen magnum.

FIG. 9.

Case of thoracopagus tetrabrachius tetrapus described as specimen No. 1 in the text.

FIG. 10.

Case of thoracopagus tetrabrachius tetrapus described as specimen No. 2 in the text.

causes, accompanied by various lesions of the viscera and usually leading to either delay in labour or to intranatal and early post-natal death of the infant. It is, as in the adult, a symptom or effect of different morbid processes rather than a disease; but the conditions which produce the antenatal form are almost certainly different from those which lead to the adult variety. Further, antenatal ascites reaches a far more deforming degree than it does in post-natal life. There is marked prominence of the abdomen with apparent dwarfing of head and limbs, while the quantity of peritoneal fluid varies greatly but is usually 4 to 8 pints. Hydramnios complicated all the 5 cases encountered, which all terminated in premature labour; all the foetûs were macerated and, except one, weighed less than 5 pounds.

The Kahn test of the mother was returned positive in 2 cases.

Three of the cases presented by the vertex and were born without difficulty and the other 2 by the breech, one of these caused difficulty by impaction of the distended abdomen and necessitated perforation of the abdomen and weighed 6 pounds 4 ounces not including the ascitic fluid.

The liver was enlarged in 2 cases, hydrocephalus complicated one, the bladder was over-distended in one case, and in 2 there was evidence of chronic peritonitis with adhesions.

(6) *Pelvis*. A large pelvis as a cause of dystocia is mentioned but not described in the literature and tumours of the sacrum (sarcoma or teratoma) are extremely rare conditions, and either abnormality has not been met, but according to Munro-Kerr, in cases of tumours of the sacrum, when the child presents by the breech, great difficulty might be experienced in determining the presenting part and if obstruction occurs the tumour should be broken up by a perforator or scissors and removed piece-meal and the trunk delivered by traction on the limbs.

## Conjoined Twins and Double Monsters

Although a pathological curiosity, a double monster should not only interest an embryologist but also a surgeon, obstetrician, and if it survives, a psychologist. An obstetrician should be interested in the subject for reasons which cannot perhaps be better expressed than by the late Professor Ballantyne, the eminent teratologist, who conducted two deliveries complicated by double monsters: "Few medical men are called upon to conduct a case of labour in which the product consists of a double monster, and even obstetricians of considerable ex-

perience will see no more than two or three confinements so complicated, in a lifetime. Nevertheless, a practitioner may any day find himself face to face with such an obstetric emergency, either in his own or in his brother practitioner's practice: it is therefore necessary for him to know what has been the usual history of such cases and in what way the difficulty in delivery may be overcome."

*Theories as to the formation of monsters in general.* The accepted belief for a long time was that monsters were, in general, freaks of nature. Several of the old beliefs as to the cause and significance of these monstrosities are interesting, but limitation of space precludes describing them. As long ago as 2000 B.C. there were cuneiform inscriptions depicting many of the same sorts of monsters which we see at the present time, together with some of the impending disasters against which they were supposed to warn; indeed the Latin verbs "to warn" and "to indicate" are "monere" and "monstrare" which indicates the origin of the term "monster".

The modern theories emphasize the altered physical and chemical factors, demonstrated by the classic work of C. R. Stockard (1921). He showed that lowering of the temperature or of the oxygen tension would result in many abnormalities including various sorts of twins. The time at which a given noxious stimulus was applied to the ovum, rather than the way in which environment was altered, determined the resulting congenital anomaly. His work led to speculation regarding human monsters as to whether toxic products of disease, alcoholism, lead, phosphorus and other types of poisoning could or did result in monsters. A. T. Hertig (1938) in summarizing Stockard's work says: "As for the application of Stockard's work in twinning, his theory can be adapted in this way: if the embryonic axis, which determines the way the embryo shall form, loses its dominance because of the altered physical or chemical environment of the ovum, other embryonic axes form and the resulting embryos become twins or triplets of that ovum."

There are three types of twin formation:

(1) Fraternal or non-identical twins—result from the simultaneous ripening and consequent fertilization of two separate ova and are thus as distinctly different as are any other two children of different birth. They may be of the same or different sex; each develops within a separate chorion, which may become adherent only through over-crowding, and pos-

sesses a separate placenta; they may or may not resemble one another; the palm, sole and finger markings do not correspond. This is the only type of twinning which should be considered physiological, and it has a hereditary basis and tends to run in families. It is four times as frequent as identical twinning.

(2) Identical, duplicate or homologous twins—result from the perfect division of the embryonic mass within a single fertilized ovum and, therefore, possess an identical germ plasma. They are invariably of the same sex; they develop within a common placenta; they greatly resemble each other usually to a point of confusion; the palm, sole and finger markings correspond in detail so far as, but not including, the minutiae.

(3a) Symmetrical double monsters (Diplopagi). They are closely related to the last and result from a partial, instead of total, separation of the embryonic mass of a single fertilized ovum, the separation being sufficient to cause a loss of continuity and hence of relation, over a greater or less extent of the surface. The components of such monstrous births are the physical duplicates of one another and will doubtless correspond in regard to palm, sole and finger configuration. The double monsters of which we have authentic record are sufficiently numerous and diverse to represent every stage from that of an otherwise normal individual with a doubling of certain of the median parts to that of two complete duplicate twins with a slight connexion between them.

(3b) Unequal double monsters (autosite and parasite). They are the result of a secondary fusion of two embryos, owing to a too great contiguity. It is probable that these are at first duplicate twins, the enclosure of which within a common chorion would furnish the crowded conditions necessary for such a fusion.

## Classification

I. Double monsters in which the components or component parts are equal to and the symmetrical equivalents of one another—Diplopagi.

(A) Teras anadidymum—twins divided at their cephalic poles only. These vary from those with double faces to those with double heads, usually without division of the neck, and are joined at the sides of and back of the head.

(1) Diprosopus (two faces).

(2) Dicephalus (two heads).

(B) Teras katadidymum—twins divided at their caudal poles only.

(1) Dipygus—fused monster with double legs, without a double pelvis (not strictly a symmetrical monster).

(2) Craniopagus—united at the heads only. Such cases are rarely joined by brain tissue.

(a) Craniopagus parietalis—joined by parietal bones, said to be the commonest type.

(b) Craniopagus occipitalis or iniopagus—joined by occipital bones or inion. An extremely rare type.

(c) Metapagus—joined by frontal bones.

(d) Acrocephalus pagus or cephalopagus—joined by tops of heads.

(3) Syncephalus—one head with two faces. The half-faces of the two components meet in the plane of union and form single faces of varying degree of completeness—Janus-headed monsters or Janiceps.

(C) Teras anakatadidymum—fused twins divided approximately at both poles with more or less fusion of thorax, abdomen and pelvis.

(1) Thoracopagus or omphalopagus—joined only in the thoracic and upper mid-abdominal regions.

(2) Xiphopagus—joined only in the regions of the umbilicus and up to the xiphoid cartilage.

(3) Pygopagus—joined by postero-external aspects of their sacrums. Very rare.

(4) Ischiopagus—joined by fusion of the pelvis end to end.

(5) Rachipagus—joined by fusion of vertebral column.

(6) Ectopagus—connected along sides of their bodies. The inner arms and legs are represented by a median limb.

(7) Prosopothoracopagus—joined by faces, necks and chests.

All the above types are further sub-classified according to the number of upper and lower limbs possessed by the double monsters, using the word "brachius" for the upper limb, and "pus" for the lower limb. For example: thoracopagus possessing four upper and four lower limbs would be sub-classified as follows: thoracopagus tetrabrachius tetrapus.

II. Unequal and asymmetrical monsters, one component of which is smaller than, and dependent upon, the other (autosite and parasite).

(A) Parasite attached to the outside of the autosite.

(1) Parasite possessed of a head, or head and arms usually attached to the autosite at or near the epigastrium.

(2) Parasite consists of the legs and more or less of the lower part of the body, without head; attached to autosite as in (1).

(3) Parasite attached to head of the autosite, frequently in the form of a supernumerary head or merely a face. It may be attached to side or back of the head or in some place. A parasite attached to the jaw bone is termed an epignathus.

(B) Parasite developed within the autosite, usually in the body cavity, but occasionally in other regions. These form tumours which usually increase and have to be removed by operative measures. Commonly termed "foetus in foetu." The parasite ranges in completeness from an almost perfect foetus to a shapeless mass containing bits of organized tissue, the so-called teratomata or dermoid cysts. In general such parasites show themselves in the autosite during the infancy or childhood of the latter, but again they may not appear until adolescence or even adult life. In location such enclosed parasites may be almost anywhere—the abdominal or thoracic cavities, the cranial cavity, the spinal canal, the scrotum or urinary bladder.

## Diagnosis and Conduct of Labour

From a clinician's standpoint a double monster is almost impossible to diagnose before the 2nd stage of labour. Writing on this aspect of the problem the late Ballantyne (1902) said: "There is still the difficulty of antepartum diagnosis of the existence of such a monstrosity. Although it may be possible for the more skilful diagnostician to suspect abnormalities of the unborn infant as a result of the palpation of the uterus, it is the general rule that malformations are not recognized till labour is in the 2nd stage and till, therefore, induction of premature labour is out of the question, and Caesarean section can only be performed under disadvantageous conditions. It must be borne in mind that the antenatal diagnosis of twins can be rarely made with certainty, the obstetrician being forced to content himself with intranatal recognition of this complication of labour. And I know of no way in which the nature of the twins can be foretold before their birth, or even if a radiogram could be made showing the presence of two foetûs, it would be useless for the diagnosis of the presence or absence of union of the

twins, unless, indeed, the union were an osseous one." This point has been objected to by Mudaliar (1930) who maintains that one could speculate on the diagnosis of double monsters, in the absence of any osseous union, by the nature of the shadow cast by the band of union in the X-ray picture. Currie (1934), in a case of hydramnios of the subacute type, which was submitted to X-ray, diagnosed the presence of an unusual foetus. A single head could be identified lying at the brim of the pelvis, and above it were two bodies. The two spines converged and appeared to unite at the base of the skull. Labour was induced by rupture of the membranes and the foetus proved to be a Janus monster classified as syncephalus monoprosopus.

Curiously enough double monsters are frequently expelled spontaneously as were the celebrated "Siamese twins", Chang and Eng, born 1811, died 1874. In Blacker's translation of R. Birnbaum's work on "Malformations of the foetus," detailed consideration is given to the mechanisms and possible methods of delivery in these cases. An analysis of 119 cases collected by Holl is given in which spontaneous delivery occurred in 62 per cent; delivery by manipulations (such as version, traction, etc.) in 23 per cent; and delivery by destructive operation in 15 per cent.

When double monsters do cause dystocia, difficult and dangerous operations are often needed to effect delivery, and the type most likely to cause difficulty are the thoracopagus twins. The usual history in a case causing dystocia is that labour has stopped, the obstetrician endeavours to find a cause, makes a careful examination of the contents of the vagina and uterus, keeping in mind the possibility of a double monster. He may have some indication as to the diagnosis; such as some associated foetal abnormality, for example cleft palate, spina bifida. R. Birnbaum, quoting Veit, states that if the first foetus in a twin pregnancy is found lying transversely, the presence of a double monster should be suspected, since such a position in an ordinary twin pregnancy is extremely rare. I endorse the second part of the above statement, as I have come across only one case of transverse presentation of the first twin in about 250 cases of twin pregnancies, but that case did not happen to be one of a double monster. If the second sac of waters can be felt the diagnosis of a double monster can be definitely dismissed. What helped me in the diagnosis of both my cases was the presence, on examination *per vaginam*, of limbs, not covered by intact membranes, in excess of the number

expected for a single foetus, for in my experience a case has not been seen in which the second sac of waters ruptured before the first twin had been delivered.

Having diagnosed conjoined twins the next step is to find out where the union may be and the plasticity of the union. Consideration should not be shown to the double monster when the mother's life is endangered, and, since the mortality is always high owing to liability of rupture of the uterus, all attention should be directed to the mother.

Treatment is dependent chiefly on the size of the monsters and the nature of the union. In general, breech presentation is the most favourable as all four legs are easily accessible, and traction on these will result in extraction of both trunks simultaneously provided the monster is not too large. The heads may be delivered one after the other or, if necessary, one of them could be perforated to lessen the bulk. In the case of a thoracopagus, which has reached the stage at which the head of the first foetus is delivered and the second is lying transversely above the brim, delivery can only be effected if the latter is small enough to undergo the mechanism of corpore conduplicato, spontaneous evolution or spontaneous version. It is recommended that the feet of the first or second (or the feet of both) should be seized and delivery of the two trunks together attempted. To render this possible the union between the twins must be plastic enough to allow of rotation through 180 degrees, and also the bodies must be small enough to allow their both being in the pelvis at the same time. If the monster is too large, or if the mother's general condition does not permit of this manipulation for fear of rupture of the uterus, evisceration of the first foetus should be proceeded with to reduce its size as then it would be possible to reach up to and draw down the region of its union with the second twin and cut this across. The second twin can then be easily delivered by version.

### Report of Cases

Case 1. W.H.C., admission No. 188, S.L., Chinese, 3-para, two normal deliveries, admitted on February 24th, 1934. Breech born as far as groins half an hour before arrival. Pains good but no advance. Foetal heart not heard. Traction applied on legs but no advance. Second pair of legs felt in vagina not covered by intact membranes. High up a band of union was felt between the twins at the level of the umbilicus. Second pair of legs were brought down and traction applied to the four legs resulted in birth of both bodies as far as their shoulders. The anterior

head was delivered by Smellie's method with a little difficulty, and then the posterior head slipped out. No perineal tear. Discharged on the 8th day of the puerperium, which was normal.

Case 2. C.A.Y., admission No. 859, K.K., Chinese, 3-para, two normal deliveries, admitted on February 22nd, 1940. Head born as far as shoulders for 6½ hours. Temperature 98.6°, pulse 138. Pains very strong. Foetal heart not heard. Traction on head tried, but failed to move it. Both arms brought down. It was obviously not a case of locked twins because it is impossible for locking to occur after the head and shoulders of the first has been born. On examination *per vaginam*, another hand was discovered uncovered by membranes, and, higher up the abdomen, the chest of the first foetus was found attached to the second foetus which was lying transversely above the brim with its head in the left iliac fossa. The union was found non-plastic. The thoracic and abdominal contents of the first twin were then eviscerated and its legs brought down. The area of junction between the twins could not be easily reached and it was cut across with scissors guided by the fingers of the left hand. The cutting involved several costal cartilages as well. The second foetus which was left lying transversely above the brim was converted into a breech presentation by internal version and delivered. The placenta was removed manually and the uterus packed. The perineum was not lacerated. The puerperium was morbid and sulphanilamide therapy resorted to. The temperature and pulse-rate came down by lysis and both were normal on the 11th day. The patient was discharged on the 14th day.

## Anatomical Study of Double Monsters

The two specimens were remarkably alike in several respects. Both possessed one placenta, one amnion and one chorion. Specimen No. 1 (that from case report No. 1) weighed 8 pounds 14 ounces, and specimen No. 2 (that from case report No. 2) weighed 8 pounds 8 ounces. Both specimens presented male foetûs joined together in the mid-line ventrally by their lower costal margins, and the upper part of the abdomen above the level of the umbilicus. There was one umbilicus in each specimen into which was inserted the single umbilical cord. There were four upper and four lower extremities and these were situated normally. There was no evidence of associated foetal mal-development, for example, cleft palate, in either specimen. The umbilical cord contained, each, four arteries and one vein. The arteries were traced back to their origins which were normal (i.e. one artery from each internal iliac artery in each foetus).

On opening both specimens the most prominent feature was a large liver placed in a common peritoneal cavity. It presented a deep fissure in the middle and on either wall of this fissure

a gall-bladder was seen. Each cystic duct joined the common hepatic duct of its own side but both the bile-ducts fused and opened into the duodenum of one of the components. There was only one umbilical vein in both specimens and in specimen No. 1 it sank into the substance of the liver at the bottom of deep fissure mentioned, while in specimen No. 2 it entered a separate fissure to one side of the median plain and then entered the porta through one substance of that side of the liver.

The alimentary canals were similar. There were two stomachs in each specimen and up to 8 centimetres beyond the stomach the alimentary canals did not show any special features. At this point the two separate small intestines entered a fusiform dilatation of the gut resembling a crop common to both. At the distal end of this crop each component had its own alimentary canal which was normal and ended in patent ani. The primitive suspension of the gut by a dorsal mesentery with three visceral branches of the aorta entering it was clearly seen in both cases. There were two spleens. The pancreas was found within the mesentery of the gut. The pelvic organs were normal except in specimen No. 2, in which one testis in either component was undescended. There were two kidneys in both specimens, but one of the kidneys in specimen No. 2 was twice larger than normal, and the suprarenal on its opposite side was absent.

The thoracic cavity was single but there were four pleural cavities. The lungs were normal.

Unfortunately the heart of specimen No. 2 was destroyed. The aortic arch of one of its components showed the right subclavian artery arising from the left and passing to the right behind the trachea. The left internal jugular vein was missing. The branches of the arch in the other component were normal.

The heart in specimen No. 1 could be studied in detail. There was only one pericardial cavity common to both and in this there was the heart. This organ was transversely elongated and projecting round from the right side there was an auricle. From the upper lateral angle on each side there was an aortic arch which gave off the main arterial trunks in the normal manner. Joining each arch to the pulmonary trunk below was a large ductus arteriosus. The interior of the heart showed a large common arterial chamber placed posteriorly. This was vaguely divided into two parts by a low ridge about the middle. In each half, the right and left arterial portions could be distinguished with difficulty. On the anterior wall of each half

there was a single atrio-ventricular orifice, which communicated with a ventricular portion on the front. Each ventricular part was separate and gave rise to an aorta. On one side of the heart there was also a right ventricular chamber, communicating with the left atrial portion of one half of the large ventricular portion of its own side. It did not communicate with the pulmonary trunk. This trunk on each side showed a blind proximal end, though the rest of its distribution was normal.

Mudaliar (1930) gives particulars of 9 specimens of double monsters collected at the museum of the Gifford School of Obstetrics, Madras, and concluding his description of 6 thoracopagi monsters among the 9 specimens he says: "It will be seen that the circulatory system probably presents a greater number of variations than any other system of the body. As a matter of fact one might not be able to find two specimens which, no matter how similar they might be in their external appearances and thoracic structure, would show approximately the same structure of the heart. Among the many varieties described as being demonstrable in the hearts of thoracopagi, certain types stand out, thus making a morphological classification possible. At the one end of this series there are those hearts which have become so completely united that there is only one auricle and one ventricle, while at the other end there are those which consist of two completely separate hearts, each contained within its own pericardium or within a common pericardium. In between these two extremes are those hearts in which there are two distinct ventricles but one common auricle, and those hearts in which the auricles are united by a streak of tissue only."

## Operation on Conjoined Twins

The question of separation is intimately connected with the degree and nature of union between the twins. A conclusion cannot be drawn from external appearances, and in some cases, although the external appearances may suggest a superficial union in the cartilaginous or soft tissues, it may be found that a far more intimate union exists in the region of the heart and perhaps in the shape of a common auricle. The aid of X-rays will be invaluable in such cases, as thereby two important systems, circulatory and alimentary, could be examined and gross malformations noted. Max Greenberg (1938) reports

a successful operation in the removal of a parasite from the host. He performed the operation when the child was 4 months old, after making sure of the anatomy by X-rays of the host after barium meals and uroselectan. At the age of 4 months the ratio of host to parasite had risen from approximately $2\frac{1}{2}$ to one at birth to four to one.

## Acknowledgments

I am indebted to Dr. H. R. Dive, the acting Director of Medical Services, S.S., for permission to publish this article, to Professor J. S. English for his advice, and to Dr. A. W. S. Thevathasan, Assistant in Anatomy, College of Medicine, for his goodness in undertaking the dissection of six of the specimens and demonstrating the salient points in their anatomy.

## Bibliography

(Arranged in alphabetical order)

Angervine, D. M. "Pathologic anatomy of hypophysis and adrenals in anencephaly," *Arch. of Path.*, 1938, xxvi, 507.

Ballantyne, J. W. "Manual of antenatal pathology and hygiene," Vols. 1 and 2. William Green, 1902.

Birnbaum, R. (translated by Blacker). "Congenital diseases and malformations of the foetus." London: J. and A. Churchill, 1912.

"British Encyclopaedia of Medical Practice," Vol. 1, 1936.

Brodsky, I. "Description of a monster, diproscopus tetrophthaloma," *Brit. Journ. of Ophthal.*, 1939, xxiii, 250.

Brodsky, I. "Four examples of iniencephalus with statistical review of the literature," *Med. Journ. of Australia*, 1939, ii, 795.

Currie, D. "A case of conjoined twins," *Proc. Roy. Soc. Med.*, 1934, xxvii, 1499.

Dodds and de Angelis. "An anencephalic human embryo 16.5 mm. long," *Anatomical Record*, 1936-37, lxvii, 499.

Dorland, W. A. N. "Iniencephalus: a case of extreme dystocia," *Surg. Gynecol. and Obstet.*, 1925, xli, 180.

Dunbar, A. E. "Teratology," *Amer. Journ. of Surg.*, 1934, xxiv, 152.

Engel, A. "On conditions resembling achondroplasia and on chondro-osteodystrophia" (Brailsford).

Finola, G. C. "Cephalothoracopagus," *Amer. Journ. of Obstet. and Gynecol.*, 1934, xxviii, 455.

Forbes, G. "A case of thoracopagus monosymmetroso," *Anatomical Record*, 1937-38, lxx, 237.

Gibberd, G. F. "A case of obstructed labour due to conjoined twins," *Proc. Roy. Soc. Med.*, 1926, xix, 46.

Greenberg, M. "Parasitic foetus successfully removed by operation," *Brit. Med. Journ.*, 1938, ii, 123.

Harbeson, A. E. "Anencephaly in the human embryo 10 mm. long," *Amer. Journ. Obstet. and Gynecol.*, 1939, xxxviii, 167.

Ho, P. H. "A case of Siamese twins," *Chinese Med. Journ.*, 1934, xlviii, 65.

Johnstone, R. J. "Caesarean section for thoracopagus twins," *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1921, xxviii, 550.

Lee, J. B. "Obstetrics," 1928, 587.

Lee, S. W. "Rare foetal monsters: with report of two cases," *Chinese Med. Journ.*, 1937, lii, 879.

Lennie, R. A. *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1927, xxxiv, 532.

Mildred, I. Ealing. "A case of Siamese twins complicated by eclampsia," 1938, xlv, 79.

Mudaliar, A. L. "Double monsters: a study of their circulatory systems, and some other anatomical abnormalities and the complications in labour," *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1930, xxxvii, 577.

Munro-Kerr. "Operative Midwifery," 1916, Baillière, Tindall & Cox.

Osler, W. "Principles and practice of medicine," 9th edition; New York; 1920, pp. 1921–23.

Reaves, B. J. "Dicephalous monster," *Amer. Journ. Obstet. and Gynecol.*, 1939, xxxvii, 166.

Shaw, Brumbaugh, Elkridge and Norey. "Anatomical and clinical study of a thoracopagus monster delivered alive at full term," *Amer. Journ. Obstet. and Gynecol.*, 1934, xxvii, 655.

Singleton, J. M. "Achondroplasia foetalis," *Amer. Journ. Obstet. and Gynecol.*, 1938, xxxv, 657.

Stockard, C. R. "Internal constitution and genic factors in growth distribution," *Symposia on Quantitative Biology*, 1934, xi, 118.

Stockard, C. R. "Dev. rate and structural expression: an experimental study of twins, double monsters and single deformities," *Amer. Journ. Anat.*, 1921, xxviii, 115.

Strachan, G. I. "Epignathus: a rare foetal monstrosity," *Journ. Obstet. and Gynaecol. Brit. Emp.*, 1930, xxxvii, 597.

Thomas, J. J. "Teratology: dicephalus tribrachius dipus: report of a case," *Journ. Tech. Methods and Bull. of Internat. Assoc. of Med. Museum*, 1938, xxviii, 86.

Vernaglia, J. B. "Iniopagus: a rare form of Siamese twins," *New Eng., Journ. Med.*, 1938, ccxix.

Wilder, H. W. "Duplicate twins and double monsters," *Amer. Journ. Anat.*, 1904, iii, 387.

# Hepatic Haemorrhage in Stillborn and Newborn Infants

## A Clinical and Pathological Study of Forty-seven Cases

BY

J. L. HENDERSON, M.D. (Edin.), F.R.C.P.E.

*Lecturer, Department of Child Life and Health, University of Edinburgh; Assistant Paediatrician, Simpson Memorial Maternity Pavilion, Royal Infirmary, Edinburgh*

HAEMORRHAGE in the intrathoracic and intra-abdominal viscera, unlike intracranial haemorrhage, is one of the less well known causes of stillbirth and neonatal death. It is frequently met with, however, and this entitles it to more consideration than it has received in the past. The incidence of visceral haemorrhage in 1,312 autopsies in the 2 principal maternity hospitals in Edinburgh during the last 7 years is given below. This figure excludes 77 severely macerated foetûs and 22 infants who died after the 28th day of life.

| | | |
|---|---|---|
| Pulmonary: pure haemorrhage ... | 55 | 81 cases |
| Pulmonary: haemorrhage + pneumonia ... | 26 | |
| Hepatic ... ... ... ... ... | 47 | ,, |
| Gastro-intestinal ... ... ... ... | 32 | ,, |
| Suprarenal ... ... ... ... | 30 | ,, |
| Renal ... ... ... ... ... | 25 | ,, |
| Various ... ... ... ... ... | 10 | ,, |

This paper is devoted to a consideration of the series of 47 cases with hepatic haemorrhage. Rupture of the liver, with intraperitoneal haemorrhage, had occurred in 24 instances. Haemorrhage in other viscera was an occasional accompaniment, while intracranial haemorrhage was seen in almost half of the cases.

Most of the literature on this subject consists of observations on small series of cases and of individual reports. Within recent years 2 large series of cases have been published. Holmberg[1] collected 56 cases of hepatic haemorrhage in her Helsinki series of just over 1,000 autopsies, and Adair (Rogers)[2] 53 cases in his Minneapolis series of 1,046 autopsies. Cruickshank[3] had 18

cases in his series of 800 autopsies on cases of neonatal death, but details are not given. Lundquist[4] observed 19 cases, and Palmer[5] 5 in his series of 99 stillborn infants.

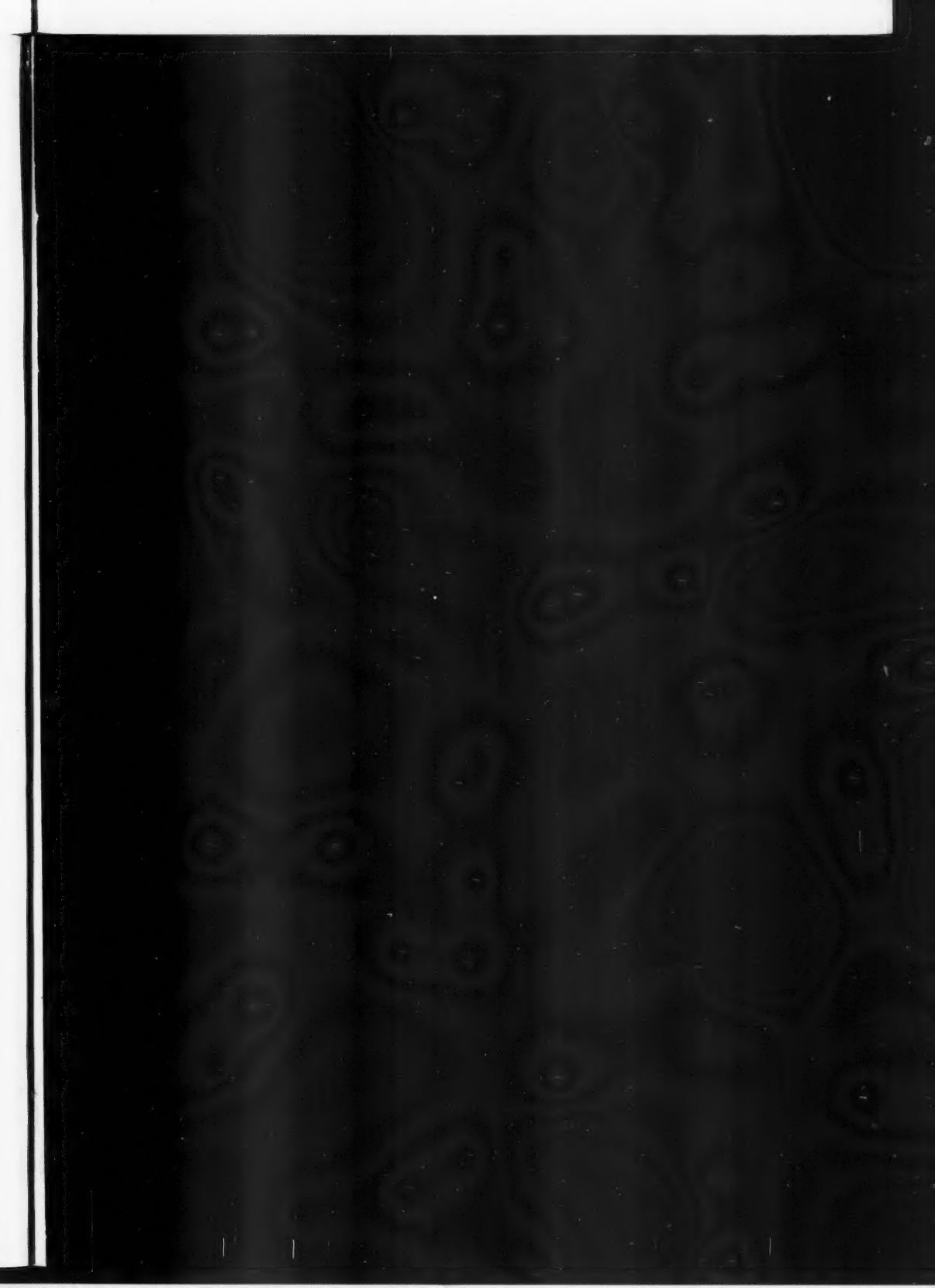
## Pathology

The principal pathological data of each case are given in Table I. It will be observed that the incidence of hepatic rupture was much higher in the stillborn infants than in those born alive. Whereas rupture had taken place in 18 of the 32 stillborn infants, it was observed in only 6 of the 15 who survived birth.

*Origin of the hepatic haemorrhage.* The bleeding usually arises from a superficial contusion or laceration of the liver parenchyma. It is unusual for the capsule to be torn by the original trauma. When the capsule is not torn it is elevated by the superficial bleeding, with the formation of a haematoma varying in size from a small blood blister to a large accumulation of blood covering an extensive area of liver surface. The haematoma may burst at any time owing to the increasing tension within it, but the precipitating factor often seems to be a sudden raising of the tension by slight external trauma, or bending of the trunk during handling.

When the original trauma is severe enough to tear the capsule, the bleeding is more acute and the child is usually stillborn. There were only 3 such cases in this series and all the infants were stillborn. Two were infants of over 10 pounds in weight in whom birth had been very difficult, and the third, a premature infant weighing $2\frac{1}{2}$ pounds, was delivered by Caesarean section. Another stillborn infant weighing 7 pounds, born after a very difficult breech delivery, displayed a deep-seated laceration in the anterior part of the right lobe without superficial involvement. I have read of only one similar case, but it may be that deep lacerations of the parenchyma are seldom revealed at post-mortem.

*Situation of the haemorrhage.* For comparative purposes one may consider separately the surfaces which adjoin the thoracic and abdominal walls and those which are more deeply situated. The former, which are necessarily more susceptible to external trauma, may be termed the superficial surfaces and the latter the deep surfaces. The cases are classified according to this definition in Table II. Three cases are included in both groups owing to the presence of both a superficially and a



TA

## OBSTETRICAL AND PA

| No. | Date | Number of pregnancy | | Mother's age | | Type of pregnancy | | LABOUR | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | DELIVERY | |
| | | First | Subsequent | Under thirty | Over thirty | Normal | Abnormal | Position | Spontaneous | Abnormal |
| | | | | | | | | | | LIV |
| 1. | 8.5.39 | + | | | 30 | | Pregnancy toxaemia | L.O.P. | | Deep transverse arrest. M rotation. Mid forceps |
| 2. | 10.1.40 | | 4 | 27 | | + | | R.O.A. | | Impacted shoulders |
| 3. | 28.6.37 | | 3 | | 30 | + | | L.O.A. | + | |
| 4. | 26.10.38 | | 2 | | 35 | | Wassermann + | R.O.A. | + | |
| 5. | 13.7.38 | | 4 | | 37 | + | | L.O.A. | + | Extended head. Prolonged (71 hours) |
| 6. | 9.8.37 | + | | 26 | | + | | R.O.A. | | Contracted pelvis, slight. F for foetal and maternal di |
| 7. | 13.10.34 | | 2 | | 33 | | Diabetes. Eclampsia | R.M.P. | | Cord round neck. Mid forc |
| 8. | 28.12.38 | | 2 | | 37 | | | R.O.A. | + | Twin birth. Combined ind |
| 9. | 26.3.40 | + | | 23 | | + | | L.O.A. | | Narrow outlet. Mid forceps |
| 10. | 18.9.34 | | 7 | | 32 | + | | L.O.A. | + | Prolapse of left arm |
| 11. | 28.9.40 | | 3 | | 31 | + | | Breech | + | Twin birth. |
| 12. | 11.9.39 | | 4 | | 36 | + | | ? Vertex | + | B.B.A. |
| 13. | 29.10.40 | + | | 19 | | | Placenta praevia | Vertex | + | Surgical induction |
| 14. | 20.1.40 | | 3 | 22 | | | Ante-partum haem. | R.O.P. | + | Face to pubis |
| 15. | 23.4.40 | | 3 | | 35 | + | | L.S.A. | + | Twin birth. Membranes ru 8 days before labour |

TABLE I

ND PATHOLOGICAL FEATURES

| nal | Birth weight | Age at death | Site of liver haemorrhage: R. lobe, anterior | Site of liver haemorrhage: Elsewhere | Rupture | Haemorrhage elsewhere: Intra-cranial | Haemorrhage elsewhere: Others | Asphyxia | Other conditions |
|---|---|---|---|---|---|---|---|---|---|
| LIVEBORN | | | | | | | | | |
| rrest. Manual | lb. oz. | | | | | | | | |
| rceps | 10 8 | 52 hours | | R. post.-sup. | + | + | | + | |
| s | 9 10 | 11 days | | R. visceral | – | | | + | Post-asphyxial pneumonia; complete transposition of viscera |
| | 8 12 | Few mins. | + | | + | | | | |
| | 8 10 | 5 days | | R. visceral | + | + | | | Severe anaemia |
| Prolonged labour | 8 0 | 4 days | + | | + | | | | |
| slight. Forceps aternal distress | 7 8 | 33 hours | + | L. anterior | + | | Suprarenal | | |
| Mid forceps | 7 6 | 32 hours | + | | – | | Thyroid | + | Post-asphyxial pneumonia |
| bined induction | 5 8 | 2 hours | | L.? position | – | + | | + | |
| id forceps | 5 4 | 22 hours | | Visceral | – | + | | + | |
| rm | 4 3 | 60 hours | ? | ? | + | | | + | Post-asphyxial pneumonia |
| | 3 12 | 5 mins. | | L. visceral | – | + | | + | |
| | 2 12 | 4 hours | | L. anterior | – | | | + | |
| | 2 12 | 1½ hours | + | | – | + | | + | |
| | 2 0 | 33 hours | + | | – | | | + | Post-asphyxial pneumonia |
| branes ruptured bour | 1 8 | 6 hours | + | | – | | | | |

TABLE I—*cont*

OBSTETRICAL AND PATHO

| No. | Date | Number of pregnancy: First | Number of pregnancy: Subsequent | Mother's age: Under thirty | Mother's age: Over thirty | Type of pregnancy: Normal | Type of pregnancy: Abnormal | LABOUR: Position | LABOUR: Delivery: Spontaneous | LABOUR: Delivery: Abnormal |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | | STILLBOR |
| 16. | 24.3.39 | | 6 | | 43 | + | | L.O.P. | | Manual rotation. Kielland's forceps |
| 17. | 20.5.39 | | 3 | | 38 | + | | Vertex | | Contracted pelvis. Tonic uterine contraction. Impacted shoulders. Craniotomy |
| 18. | 13.5.35 | | 3 | | 36 | + | | P.O.P. | | Manual rotation. Mid forceps. Impacted shoulders |
| 19. | 2.4.39 | | 3 | 25 | | | Pregnancy toxaemia | R.O.L. | | Mid forceps. Impacted shoulders |
| 20. | 2.5.39 | | 2 | 23 | | + | | R.O.L. | | Prolapse of cord. Impacted shoulders |
| 21. | 21.4.40 | + | | 26 | | + | | L.S.A. | + | Prolonged labour |
| 22. | 16.12.40 | | 2 | | 32 | + | | R.O.P. | | Prolapse of cord. Impacted shoulders |
| 23. | 27.11.39 | | 4 | | 30 | + | | R.O.L. | | Prolapse of cord. Low forceps |
| 24. | 5.7.40 | + | | 25 | | + | | R.O.P. | | Prolonged labour. Maternal distress. Mid forceps |
| 25. | 17.7.33 | | 3 | | 38 | + | | R.O.P. | | Manual rotation. Foetal distress. Mid forceps |
| 26. | 25.11.40 | | 11 | | 41 | + | | L.O.A. | | Extended head. Prolonged labour. Upward extension of arms. Internal version. Breech extraction |
| 27. | 6.1.38 | + | | 22 | | + | | Breech | | Frank breech |
| 28. | 14.10.40 | | 5 | | 31 | + | | Vertex | | Prolapse of cord. Internal version |
| 29. | 4.1.40 | | 2 | 33 | | + | | L.O.A. | | Failed forceps. Internal version. Breech extraction |
| 30. | 15.1.40 | + | | 25 | | + | | R.O.P. | | Forceps rotation. Mid forceps |
| 31. | 31.3.39 | + | | 29 | | + | | R.O.P. | | Failed forceps. Manual rotation. Mid forceps |
| 32. | 25.4.39 | | 5 | | 36 | + | | L.O.A. | | Transverse lie. External version. Medical induction. Cord around neck and body |
| 33. | 18.6.34 | + | | 20 | | + | | L.O.A. | | Funic presentation. Mid forceps |
| 34. | 16.10.37 | + | | 24 | | + | | R.O.A. | + | Combined induction |
| 35. | 18.7.39 | | 6 | 29 | | + | | R.S.P. | | Extended arms. Fifteen minutes delay with head |
| 36. | 18.4.39 | | 2 | | 31 | + | | R.O.P. | | Foetal distress. Low forceps |
| 37. | 27.1.36 | | 2 | 20 | | + | | R.O.L. | | Contracted pelvis. Low forceps |
| 38. | 20.11.40 | | 2 | | 34 | + | | R.O.P. | | Oedema of cervix. Prolonged labour. Craniotomy |
| 39. | 21.4.39 | + | | 23 | | | Placenta praevia | L.O.A. | + | Surgical induction. Thymophysin ½ c.c. × 3 during labour |
| 40. | 19.7.40 | | 12 | | 38 | | Placenta praevia | Vertex | + | Surgical induction |
| 41. | 22.12.40 | | 13 | | 36 | | Accidental haem. | L.O.A. | + | Surgical induction |
| 42. | 5.9.40 | | 2 | 22 | | | Accidental haem. | Breech | | Assisted breech |
| 43. | 7.2.39 | + | | 22 | | | Pregnancy toxaemia | R.O.A. | + | Combined induction |
| 44. | 4.9.35 | | 2 | 27 | | + | | L.O.A. | + | Premature rupture of membranes |
| 45. | 13.4.34 | | 2 | | 34 | | Placenta praevia | R.S.A. | | Twin birth. Assisted breech |
| 46. | 11.1.40 | + | | 25 | | | Eclampsia | | | Caesarean section |
| 47. | 27.1.39 | | 6 | | 33 | + | | R.S.A. | | Prolapse of cord. Assisted breech for extended arms |

I—*continued.*

PATHOLOGICAL FEATURES

| | Birth weight | | Site of liver haemorrhage | | | Haemorrhage elsewhere | | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | R. lobe, anterior | Elsewhere | Rupture | Intra-cranial | Others | Asphyxia | Other conditions |
| TILLBORN | lb. oz. | | | | | | | | |
| 's forceps | 11 4 | | | R. visceral | + | + | | + | |
| c uterine | | | | | | | | | |
| d shoul- | 10 8 | | + | L. anterior | + | | | + | |
| forceps. | | | | | | | | | |
| | 10 4 | | + | | + | | | + | Fractured clavicle |
| oulders | 10 2 | | | Visceral | + | | Suprarenal | | |
| ed shoul- | 9 14 | | + | | − | | | + | |
| | 9 8 | Macerated | + | R. visceral | + | | | + | |
| ed shoul- | | | | L. anterior and | | | | | |
| | 9 5 | | + | R. visceral | − | + | Suprarenal | + | |
| rceps | 9 4 | | | L. anterior and R. post.-sup. | + | + | | | |
| rnal dis- | 8 13 | | + | | + | + | | + | |
| distress. | 8 10 | | + | | + | | | + | |
| d labour. | | | | | | | | | |
| rms. In- | | | | | | | | | |
| xtraction | 8 9 | | | L. anterior | − | | | + | |
| | 8 3 | | | L. anterior | − | + | | + | Fractured femur |
| l version | 8 3 | | + | | − | + | | | |
| version. | | | | | | | Retroperi- | | |
| | 8 2 | | + | | − | | toneal | + | |
| rceps | 8 1 | | | R. post.-sup. | + | + | | + | Post-asphyxial pneumonia |
| rotation. | 7 13 | | | L. anterior | − | + | Duodenal | + | |
| version. | | | | | | | | | |
| d around | 7 1 | Macerated | | L. anterior | + | | | + | |
| forceps | 7 0 | | + | | − | | | + | |
| | 7 0 | | + | | + | | Suprarenal | + | |
| minutes | 7 0 | | Internal | | − | + | | + | |
| eps | 6 14 | | + | | + | + | | | |
| orceps | 6 13 | | | L. anterior | − | + | | | |
| nged lab- | 6 8 | Macerated | | L. anterior | + | | | + | |
| nophysin | 6 3 | | + | | + | + | | | |
| | 5 6 | | + | | − | | | + | |
| | 5 3 | | | L. anterior | − | | | + | |
| | 4 12 | Macerated | + | | − | | | + | |
| | 4 10 | Macerated | + | | + | | | + | |
| mbranes | 4 4 | | | L. anterior | + | | | + | |
| ech | 3 5 | | ? | ? | − | + | Pulmonary | + | |
| | 2 6 | | + | | + | | | | |
| ed breech | Premature | | | L. anterior | + | + | | + | |

deeply situated haematoma. More than 1 haematoma was observed in 7 cases.

TABLE II

CLASSIFICATION OF CASES ACCORDING TO SITUATION OF HEPATIC HAEMORRHAGE IN 42 CASES (SEE TEXT).

| Group | Surfaces | No. of cases | |
|---|---|---|---|
| Superficial | R. lobe, ant. and ant.-lat. | 21 | 35 |
| | R. and L. lobes, ant. | 3 | |
| | L. lobe, ant. | 11 | |
| Deep | R. lobe, visceral | 4 | 11 |
| | L. lobe, visceral | 1 | |
| | ? lobe, visceral | 3 | |
| | R. lobe, post.-sup. | 3 | |

Table II shows the preponderance of the superficial group. Figs. 1 and 2 illustrate large haematomata in the superficial group and Fig. 3 shows a haematoma in the deep group.

*Size of haematoma and degree of haemoperitoneum.* The size of the haematoma was mentioned in 42 of the 43 cases with subcapsular haemorrhage. It was described as large in 18 cases, namely, with an area of several square inches, as medium in 7 and as small in 17, namely, with an area of less than 1 square inch.

The degree of haemorrhage into the peritoneal cavity in the 24 cases with rupture was usually severe. It was massive in 15 cases, considerable in 6 and in 3 slight. This large series of post-mortem examinations contains only 2 cases with intraperitoneal haemorrhage which could not be traced to the liver. A large suprarenal haematoma had ruptured in 1 case, while the source could not be found in the other.

*Associated haemorrhage.* (See Table I.) Intracranial haemorrhage occurred in 20 infants. Fourteen were stillborn and 6 died within a few days of birth. The haemorrhage was combined in 7 cases. There were 16 infants with subdural haemorrhage, 8 with subarachnoid haemorrhage, and 3 with intraventricular haemorrhage.

Suprarenal haemorrhage occurred in 4 cases, of which 3 were in stillborn infants.

Pulmonary haemorrhage, duodenal haemorrhage, and retroperitoneal haemorrhage were all observed once in stillborn

infants, and thyroid haemorrhage in an infant who died on the second day.

*Asphyxia.* Signs of asphyxia were found in 35 of the 47 infants (Table I). There was post-mortem evidence in 33, and the remaining 2 infants, though not showing definite morbid signs, were severely asphyxiated at birth. Haemorrhage, other than hepatic, was observed in 16 of these cases.

*Pneumonia.* Pneumonia of the post-asphyxial type occurred in 5 infants (Table I). Four of the infants lived for a short time, 1 as long as 60 hours, and the fifth was stillborn. Aspirated material was found in 4 cases. This causes patches of atelectasis in which pneumonia, resulting from chemical or bacterial irritation, is apt to occur (Macgregor[6]). In the 5th case the pneumonia had developed in an atelectatic lung in which there were no signs of aspirated matter.

*Fractures.* One stillborn infant had a fractured femur and another a fractured clavicle.

## Clinical Features

*Incidence.* In conformity with the experience of others, the incidence of hepatic haemorrhage in this series was found to be considerably higher in stillborn infants than in those who died after birth (Table III). It was 3 times as great in stillborn infants as in those who died within 1 week. Only 1 of the fatal cases lived longer.

The incidence of hepatic haemorrhage is much higher in abnormally large infants and in premature infants than in those weighing $5\frac{1}{2}$ to 8 pounds. The latter constitute the majority of livebirths. Table IV shows the predominance of prematures in Holmberg's series. Holmberg believes that minor degrees of hepatic haemorrhage may sometimes occur in surviving infants. The fact that it is rarely seen in those dying after the 1st week suggests that the conditions which produce it usually prove fatal.

*Time of death.* In stillborn infants failure of the foetal heart was usually observed during labour. Five of the 32 infants were slightly macerated. They all showed signs of asphyxia. Labour was prolonged in 2 of these cases, but not in the other 3 in which death must have occurred before its inception. The question arises whether hepatic haemorrhage may occur during the delivery of a dead foetus. There is no reason to suppose that it did so in any of the slightly macerated foetûs mentioned above.

FIG. 2.

Liver of case 26 (Table I) showing a large unruptured subcapsular haematoma on the anterior surface of the left lobe.

FIG. 1.

Liver of case 5 (Table I) showing a large subcapsular haematoma on the antero-lateral surface of the right lobe. A large amount of blood had leaked into the peritoneal cavity.

FIG. 3.

Liver of case 4 (Table I and page 383) showing a large subcapsular haematoma on the visceral surface of the right lobe. A large blood clot may be seen, within the dotted line, protruding through a rent in the capsule. Massive intraperitoneal haemorrhage occurred and the infant was almost exsanguinated.

The intraperitoneal haemorrhage was severe in 4 infants and, therefore, could only have arisen ante-mortem, while in the 5th, with an unruptured subcapsular haematoma, the signs of asphyxia were particularly severe.

TABLE III

INCIDENCE OF HEPATIC HAEMORRHAGE IN RELATION TO TIME OF DEATH

| | No. of cases | No. of post-mortems | Incidence, per cent |
|---|---|---|---|
| Stillborn infants ... ... ... | 32 | 436 | 7·34 |
| Infants dying in 1st week ... ... | 14 | 590 | 2·37 |
| Infants dying in 2nd to 4th weeks inclusive ... ... ... | 1 | 286 | 0·35 |

TABLE IV

COMPARISON OF THE NUMBER OF CASES OF HEPATIC HAEMORRHAGE IN THE VARIOUS WEIGHT GROUPS IN TWO SERIES OF CASES

| | Author's series | Holmberg's series |
|---|---|---|
| 10 pounds and over ... ... ... | 5 | — |
| 8 to 10 pounds ... ... ... ... | 15 | 8 |
| 5½ to 8 pounds ... ... ... ... | 11 | 6 |
| 2⅛ to 5½ pounds ... ... ... ... | 14 | 33 |
| Under 2⅛ pounds ... ... ... | 2 | 9 |

TABLE V

AGE AT DEATH OF LIVEBORN INFANTS IN TWO SERIES OF CASES

| | Hours | | Days | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | Under 6 | 6 to 24 | 2 | 3 | 4 | 5 | 6 | 7 | 11 |
| Author's series | | | | | | | | | |
| Ruptured liver ... ... | 1 | – | 2 | 1 | 1 | 1 | – | – | – |
| Subcapsular haematoma ... | 5 | 1 | 2 | – | – | – | – | – | 1 |
| Holmberg's series | | | | | | | | | |
| Ruptured liver ... ... | 2 | – | 1 | 2 | 1 | – | – | – | – |
| Subcapsular haematoma ... | 7 | 2 | 3 | 1 | 2 | – | – | 1 | – |

TABLE VI

FREQUENCY OF FOETAL POSITIONS

| | No. of cases |
|---|---|
| Occipito-anterior ... ... ... ... ... | 17 |
| Occipito-lateral ... ... ... ... ... ... | 4 |
| Occipito-posterior ... ... ... ... ... | 11 |
| Occipito-? ... ... ... ... ... ... ... | 5 |
| Mento-posterior ... ... ... ... ... ... | 1 |
| Breech ... ... ... ... ... ... ... | 8 |

TABLE VII

CLASSIFICATION OF SPONTANEOUS DELIVERIES

| | No. of cases |
|---|---|
| Normal spontaneous ... ... ... ... ... | 3 |
| Premature rupture of membranes ... ... ... | 2 |
| Induced ... ... ... ... ... ... ... | 7 |
| Minor abnormalities and manipulations ... ... | 5 |

All except 1 of the 15 infants which survived birth died within a week—6 of them within a few hours (Table V). Of 55 foetûs collected from the literature which survived birth—and this is by no means exhaustive—only 1 survived for longer than a week, but it was atypical. It was a marasmic infant of 8 weeks, and an enormous cystic haematoma occupying two-thirds of the liver was found at post-mortem.

*Obstetrical factors.* An analysis of the obstetrical details (Table I) emphasizes the high incidence of difficult delivery. In this series of 47 cases, 26 of the mothers were over 30 years of age and 13 of these were over 35. There were 33 multiparae. It would seem that hepatic haemorrhage predominates in the infants of elderly multiparae. The incidence of abnormal pregnancy was considerably raised. Two of the mothers had eclampsia—1 of which had diabetes, 3 pre-eclamptic toxaemia, and 7 ante-partum haemorrhage. There were only 4 mothers with small pelvic dimensions.

The frequency of the foetal positions is shown in Table VI. They were abnormal in half of the cases.

The 17 spontaneous deliveries are classified in Table VII. Only 3 were entirely normal. It is noteworthy that 1 infant—a premature—was delivered by Caesarean section.

*Clinical signs of ruptured liver.* Hepatic haemorrhage in the newborn is seldom diagnosed during life. Yet some of those who survive for more than 24 hours present a characteristic picture which is easy to recognize if the possibility of ruptured liver is borne in mind. It is produced by the rupture, with massive haemorrhage, of a pre-existent subcapsular haematoma into the peritoneal cavity.

Of the 37 cases of ruptured liver collected from the literature, in which the infants were born alive, the clinical signs were discussed in only 22 instances. These cases were published by the following authors: Brodhead,[7] 2; Raisz,[8] 1; Berry,[9] 1; Green,[10] 1; Gennell, [11] 2; McNitt,[12] 2; Pim and Barlow, [13] 1; Gymnich,[14] 1; Nussbaum,[15] 1; Hussy,[16] 2; Holmberg, 2; Meyer,[17] 1; Rogers, 3; Silver,[18] 1; Hiilesmaa,[19] 1. One infant died towards the end of the 1st day and another on the 6th day. The survival time of the remaining 20 infants was fairly evenly spread over the 4 intervening days. An analysis of the principal features in these 22 cases shows that there was a sudden onset of signs of severe illness in at least 14. The most outstanding and characteristic sign is the sudden appearance of severe anaemia which occurred in 19 of these infants. Dyspnoea was a feature in 11, restlessness and crying in 7, signs of shock in 7, and in 6 abdominal distension. Cyanosis was observed in 4 and in 3 vomiting.

Only 2 of the infants of the 5 fatal cases of this series with ruptured liver who survived for longer than 1 day were personally observed. In 1 the signs were indefinite, but in the other they were characteristic. The principal features of this case are worthy of note:

CASE 4 (Table I). Baby H., a male infant weighing 6½ pounds, was born spontaneously after a labour of 6¼ hours' duration. He was the 2nd child of a 35-year-old mother. The condition at birth was satisfactory and progress appeared favourable until the 4th day when severe pallor suddenly appeared. When seen a few hours later, the abdomen was distended, somewhat doughy and apparently painful. There was, also, pronounced dyspnoea and vomiting. On the following day the abdomen became greatly distended and there were signs of shock. Shortly before the infant died on the 6th day the haemoglobin had fallen to 23 per cent (Sahli) and the erythrocyte count to 830,000 per c.mm. A very large amount of blood was found in the peritoneal cavity at autopsy. It had arisen from a large subcapsular haematoma on the visceral surface of the right hepatic lobe (Fig. 3).

It is apparent that the sudden onset of severe anaemia in an infant who has recovered from the ordeal of birth, and in whom signs of alimentary bleeding are absent, should arouse the suspicion of intraperitoneal rupture of a subcapsular haematoma of the liver. None of the other signs would be likely to do so, but abdominal distension affords useful confirmatory evidence of the cause of this type of anaemia. The rapid development of severe anaemia which may occur in that form of erythroblastosis known as anaemia haemolytica neonatorum should not cause confusion, as the good general condition is a remarkable feature of such cases. A blood examination would dispel any doubt. As the cases on which the above clinical analysis is based were collected from independent sources, it is unsafe to assume that this sign usually occurs. Unfortunately, Holmberg, in her series, said little of the clinical signs in the 6 cases of ruptured liver which survived birth.

## Aetiology

It has been conclusively demonstrated that complicated labour is the principal cause of hepatic haemorrhage in the foetus during birth. It would appear that multiparity, with its greater attendant risks, is an important factor. In only 4 mothers in this series was the pelvis contracted. It is a less common cause of complicated labour than formerly, and one supposes that in the days when the rachitic pelvis was more prevalent the incidence of hepatic haemorrhage must have been higher. Gennell described the case of a woman, with an obliquely contracted pelvis, whose 2nd and 3rd babies both had a ruptured liver following prolonged but spontaneous delivery. Little will be gained by discussing in detail the mechanism of the traumatic element. It has been shown that the haemorrhage occurs most frequently on the anterior surface of the right lobe which is the most exposed part of the organ. The sacral promontory and the symphysis would appear to be the principal traumatizing agents. The higher incidence in breech deliveries is probably accounted for by the greater amount of manipulation of the trunk which is necessary in such cases.

The frequent occurrence of haemorrhage in situations where trauma cannot be regarded as an important causal factor shows that there must be other influences at work. Hyperphlebaemia—a normal accompaniment of birth—asphyxia and a prolonged clotting time, may each play a part in the aetiology. Venous

congestion renders tissues unduly friable and accentuates the effects of trauma. Asphyxia would appear to be the principal factor when haemorrhage occurs in protected organs, such as the lungs. The same argument may be applied to haemorrhage on the deep hepatic surfaces, although here the effect of indirect trauma cannot be excluded. In the presence of extensive haemorrhage, pronounced exacerbation would be likely to occur during the 2nd to 4th days of life when clotting is deficient. Macpherson *et al.*[20] have shown that the prothrombin index of the cord blood of infants born after complicated labour is often abnormally low, and that the physiological fall, which occurs in the index chart from the 2nd to the 4th days of life, shows pronounced accentuation.

The vast majority of cases of hepatic haemorrhage are produced during birth, but the condition may also arise antenatally and post-natally. In the antenatal type, foetal manipulations such as external version, trauma to the abdomen by falling and eclamptic fits, have all been incriminated. The occurrence of the condition in an infant (No. 46) delivered by Caesarean section leaves no room for doubt that the condition can arise antenatally. The mother was suffering from eclamptic fits and had fallen against the kitchen grate in one of these before admission to hospital. The baby was deadborn. The hepatic laceration must have been produced either by the fall or during a convulsion. Bureau (Hédren[21]) observed a similar case. This infant died half an hour after delivery by Caesarean section, the mother having died from eclampsia a few minutes earlier. There was a large subcapsular haematoma with a tear of the overlying capsule and massive haemoperitoneum. Intra-uterine asphyxia would appear to be the principal factor in the antenatal group.

It is easier to visualize the origin of the condition post-partum. Violent methods of resuscitation which, happily, are no longer practised, were regarded by the earlier authors as one of the chief causes of damage to the foetal liver. Schultze's method received especial condemnation, but they probably over-estimated its danger in this respect and regarded many of the

* Since writing this paper, a large subcapsular hepatic haemorrhage has been found in an infant with haemorrhagic disease. The prothrombin index was 33 per cent in this infant and 30 per cent in its twin. Both weighed about 2½ pounds and died within 4 days of birth. The cause of death, in both, was extensive subarachnoid and intraventricular haemorrhage. Pulmonary and intestinal haemorrhage were also found in the infant with hepatic haemorrhage.

intrapartum cases as having arisen in this way. Nussbaum recorded a case caused by a midwife who performed resuscitation by placing the thumbs under the costal margins and pressing upwards. Medical jurists recognize violence connected with concealed birth as an occasional cause. It is doubtful whether traction on the umbilical cord can damage the liver, as it will not stand much strain without snapping.

## Treatment

The knowledge that the physiological fall in the prothrombin index curve is greatly accentuated in cases of prolonged labour is now being applied in obstetrics. Macpherson *et al.* have shown that the administration of a vitamin K analogue, either to the mother between 12 and 4 hours before delivery or to the infant within 24 hours of birth, maintains the prothrombin index at a high level during the first few days of life. In any case of manifest or suspected haemorrhage in a newborn infant, vitamin K should be administered at once if it has not been given prophylactically. It is most effective in the treatment of haemorrhagic disease of the newborn in which the prothrombin index falls very low (Kugelmass[22]). It is difficult, however, to estimate its value in other types of haemorrhage in the newborn when trauma and asphyxia are the principal aetiological factors. Pending further evidence, it would seem advisable not to expect much benefit from the administration of vitamin K in these circumstances.

When the characteristic sudden anaemia develops in a newborn infant from rupture of a subcapsular haematoma of the liver the fact of intraperitoneal haemorrhage may be confirmed by paracentesis, as recommended by Rogers. An attempt should then be made to save the infant's life by giving an immediate blood transfusion followed by laparotomy at the earliest possible moment. After locating the source of the bleeding, an attempt is made to suture the rent in the capsule. This will not always be possible, but it should be so in most instances, as rupture usually occurs in an accessible part of the liver. There is only one recorded case of recovery following surgical intervention. This was an infant in the clinic of Rubovitz and Strauss at Chicago (Rogers). It has already been pointed out that only a small proportion of the minority which survive birth can be recognized clinically and, therefore, the opportunity of undertaking surgical treatment seldom arises. Nevertheless, early

diagnosis and prompt surgical treatment should render the outlook distinctly hopeful in such cases.

## Summary

Forty-seven cases of hepatic haemorrhage collected from a series of 1,312 post-mortem examinations on stillborn and newborn infants have been analysed.

Rupture of the liver, with intraperitoneal haemorrhage, was found in 24 cases, an unruptured subcapsular haematoma in 22, and in 1 a deep-seated laceration.

The haemorrhage was situated on a surface subjacent to the abdominal or thoracic wall in three-quarters of the cases.

There was an associated intracranial haemorrhage in 20 cases. Visceral haemorrhage, other than hepatic, occurred in several instances.

Signs of asphyxia were observed in three-quarters of the cases.

The condition was 3 times as frequent in stillborn infants as in those who died within a week of birth.

The incidence was much higher in abnormally large infants and in premature infants than in those of average weight.

Obstetrical abnormalities occurred in the great majority. In only 3 cases has the delivery of the mothers been normal and spontaneous.

A diagnosis is seldom made during life in those infants who survive birth. The sudden appearance of severe anaemia during the first few days of life should lead one to suspect the intraperitoneal rupture of a subcapsular haematoma of the liver. This is the outstanding clinical sign.

Complicated labour is the chief predisposing cause of hepatic haemorrhage. External trauma is the principal precipitating factor, but the asphyxial element is very important.

The existence of intraperitoneal haemorrhage should be confirmed by paracentesis. The source is hepatic in the vast majority of cases. Transfusion should be given for severe anaemia and surgical intervention attempted. One case of recovery following suture of a hepatic laceration has been recorded.

Prophylaxis is now being attempted for haemorrhage in the newborn by the administration of vitamin K to the mother before parturition or to the infant shortly after birth. Either procedure maintains the prothrombin index of the blood at a high level during the first few days of life.

## Acknowledgments

Thanks are due to Professor Charles McNeil and to Professor R. W. Johnstone for their interest in this work, to Dr. Agnes Macgregor for the pathological reports, and to the obstetrical staffs of the Simpson Maternity Pavilion, The Royal Infirmary, and of the Elsie Inglis Maternity Hospital for permission to use their records.

## References

1. Holmberg, E. *Finska Läk Sällsk. Handl.*, 1933, lxxv, 1067.
2. Rogers, G. *Amer. Journ. Obstet. and Gynecol.*, 1934, xxvii, 841.
3. Cruickshank, J. N. "The causes of neonatal death," *Spec. Rep. Ser. Med. Res. Coun.*, London, 1930, No. 145, p. 60.
4. Lundquist, B. *Acta Obstet. Gynec. Scand.*, 1930, ix, 331.
5. Palmer, A. C. "The cause of foetal death in 144 cases," *Spec. Rep. Ser. Med. Res. Coun.*, London, 1928, No. 118, p. 67.
6. Macgregor, A. R. *Arch. Dis. Childh.*, 1939, xiv, 323.
7. Brodhead, G. L. *Amer. Journ. Obstet. and Gynecol.*, 1917, lxxv, 1067.
8. Raisz, D. Abstracted in *Zentralb. f. Gynäkol.*, 1925, xlix, 2743.
9. Berry, J. A. *Brit. Med. Journ.*, 1926, i, 825.
10. Green, H. *Arch. Pediat.*, 1926, xliii, 627.
11. Gennell, S. *Acta Obstet. Gynec. Scand.*, 1930, ix, 180.
12. McNitt, H. J. R. *Amer. Journ. Obstet. and Gynecol.*, 1932, xxiii, 431.
13. Pim, H. A., and H. C. Barlow. *Brit. Med. Journ.*, 1932, i, 887.
14. Gymnich, F. *Monats. f. Geburtsh. u. Gynäkol.*, 1932, xci, 31.
15. Nussbaum, S. *Amer. Journ. Dis. Child.*, 1932, xliv, 146.
16. Hussy, P. *Zentralb. f. Gynäkol.*, 1933, lvii, 59.
17. Meyer, H. S. *Arch. Pediat.*, 1933, l, 814.
18. Silver, H. B. *Journ. Pediat.*, 1938, xiii, 542.
19. Hiilesmaa, V. *Duodecim*, 1938, liv, 531.
20. Macpherson, A. I. S., E. McCallum, and W. F. T. Haultain. *Brit. Med. Journ.*, 1940, i, 839.
21. Hédren, G. *Vjschr. Gerichtl. Med.*, 1917, liv, 230.
22. Kugelmass, I. N. *Arch. Dis. Childh.*, 1940, xv, 97.

# A Case of Sarcoma of the Femur Complicating Pregnancy

BY

JOHN ST. GEORGE WILSON, *M.C.*, M.B., Ch.M. (Liverpool), F.R.C.S. (Eng.), F.R.C.O.G.

*Hon. Obstetric and Gynaecological Surgeon, Royal Infirmary, Liverpool*

MRS. T., aged 30, was admitted to hospital complaining of pain, which she described as hot, and like needles shooting from the right thigh down to her leg.

She was pregnant for the fourth time, and was uncertain as to the date of onset, but believed she was then about 32 weeks.

The first child had been born alive, normally, but the second and third, though delivered normally, were stillborn.

The pain had been present throughout the pregnancy, and a few days previously her sister had remarked that the right thigh was somewhat swollen (Fig. 1).

On admission there was a slight swelling of the outer part of the right thigh about the junction of the upper and middle thirds, and this was felt to be due to an indefinite enlargement of the bone with thickening of the surrounding muscles.

There was no tenderness. The temperature and pulse-rate were normal. The urine contained a trace of albumin, with a few hyaline casts, and calcium oxalate crystals. The Wassermann reaction was negative, and the white cell count was 10,100 per c.mm.

## PREGNANCY

The foetus was felt presenting by the vertex, which is shown in Fig. 1, and was estimated to be about 34 weeks' gestation.

X-ray examination (Fig. 2) showed a swelling of the upper part of the shaft of the femur with irregularity of the outline, and a raising-up of the periosteum.

Dr. R. E. Roberts was then of the opinion that the X-ray appearance suggested that of Ewing's sarcoma. It was then suggested that a biopsy should be made to establish the differential diagnosis between neoplasm and a chronic inflammatory lesion.

On biopsy, it was noted that the condition was undoubtedly neoplastic, that the growth appeared encapsuled, and was penetrating the periosteum, and was felt as a mushy mass in which spicules of bone could be detected.

Microscopic examination of fragments removed, both of soft growth and a piece of invaded bone, showed the presence of a rather large round-celled sarcoma, the cells of which were invading bone and connective tissue, and tended to be arranged in groups (Fig. 3).

It was decided that the microscopic appearance supported the radiological diagnosis of Ewing's sarcoma, and the treatment determined was to conserve the pregnancy and the limb, and to treat the neoplasm with deep X-ray owing to the marked radiosensitivity of Ewing's tumour.

As regards amputation, it was argued that it was then too late to remove the limb to do any good.

Some delay in commencement of deep X-ray therapy was inevitable as it was necessary for the skin incision of the biopsy to heal and the patient had to be transferred to another institution, where deep X-ray therapy was available.

When deep X-ray was commenced some 3 weeks later, it was found that a pathological fracture had occurred (Fig. 4).

Thomas's knee splint was applied to the limb, and X-ray treatment was continued until 2 weeks later when labour was ushered in by a premature rupture of the membranes, and a living child 7 pounds $2\frac{1}{2}$ ounces in weight, and 20 inches in length, was delivered by the breech.

The placenta appeared to be normal, and careful microscopical examination did not reveal the presence of any metastasis.

The condition of the leg became worse, the swelling was increased, and the pain was becoming intolerable.

Dr. R. E. Roberts was then of the opinion that the X-ray appearance was that of an osteogenic sarcoma, and it was finally decided to amputate the leg through the hip joint, in order to make the patient more comfortable rather than with any idea of cure, though radiological and clinical examination of the lungs did not yet reveal any metastasis in the chest.

Since the operation, 6 weeks ago, the patient has had almost continuous pyrexia, the cause of which has not been discovered.

In the literature there are a few references to sarcoma of bones other than the pelvic bones.

McCoogan[1] in a review of malignant diseases in pregnancy

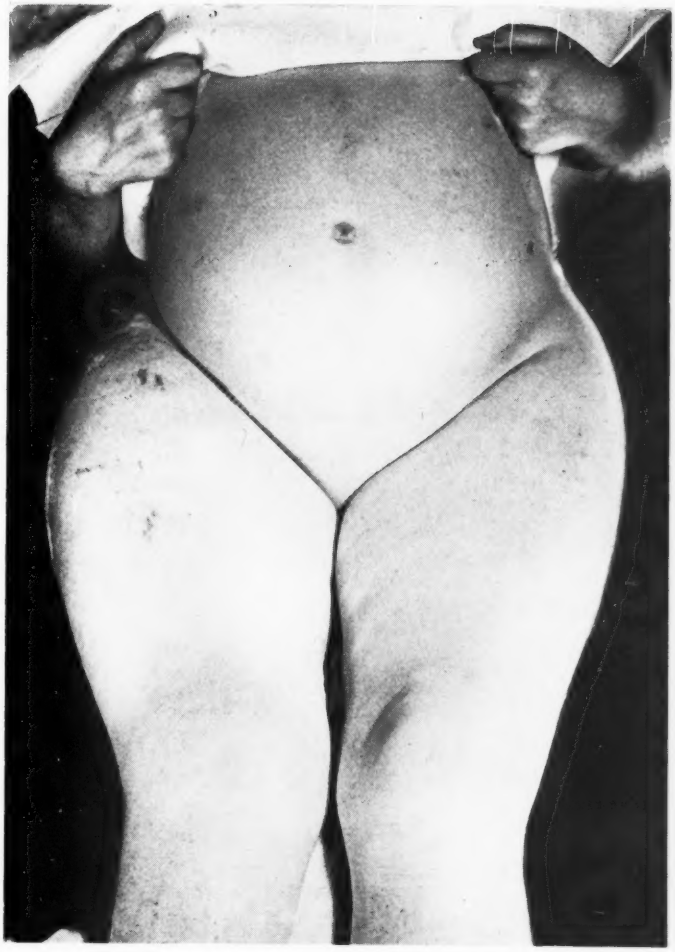


FIG. 1.

St. G. W.

FIG. 2.

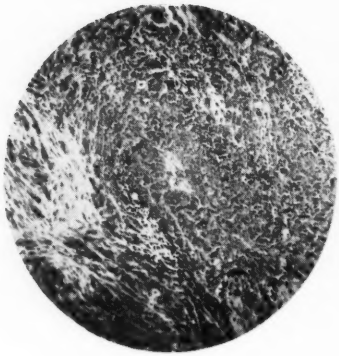


FIG. 3 (*a*) × 54.

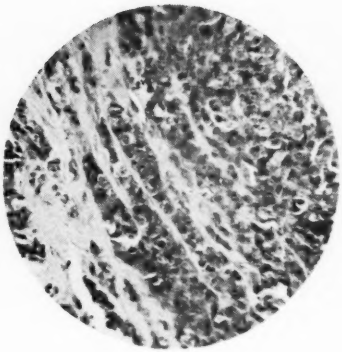


FIG. 3 (*b*) × 156.

FIG. 4.

FIG. 5.

UNIV. OF MICH.

relates a case of osteogenic sarcoma of the femur which was known to be present before pregnancy occurred, and was treated by X-ray both before and after that. The bone showed marked decalcification.

Barnes[2] reported a case of metastatic sarcoma in an ovary during pregnancy.

Vaille,[3] quoted by McCoogan, reported a case, and collected 17 cases from the literature up to date, and stated that in 9 of these, growth was rapid in the puerperium.

The specimen (Fig. 5) consists of the thigh which has been incised in the mid-line, in front, the biopsy incision scar is on the outer side, and the femur has been sawn obliquely along its length.

The fracture is to be seen, and the growth extending along the medulla of the bone. The soft friable growth is to be noted extending through the surrounding muscles of the thigh as far as the deep fascia.


REFERENCES

1. McCoogan, L. S. *Surg. Gynecol. and Obstet.*, 1937, lxv, 145.
2. Barnes, C. S. *Amer. Journ. Obstet. and Gynecol.*, 1935, xxix, 734.
3. Vaille. *Internat. Clinic.*, 1918, ii, 143.

# Obituary

## William Smyly, M.D., F.R.C.P.I., F.R.C.S.I., Hon. F.R.C.O.G.

We regret to announce the death of Sir William Smyly, who was one of the foundation shareholders of this journal. He had reached the great age of 91, but in spite of this had continued his active interest in obstetrics and gynaecology although he had retired from practice for a considerable period. He had a strong medical background, for he was the third son of Josiah Smyly, M.D., and his elder brother was Sir Philip Smyly, who was Surgeon-in-Ordinary to Queen Victoria in Ireland. His wife was the daughter of Henry Tweedy, M.D., so he was connected by marriage with Hastings Tweedy, who later succeeded him as Master of the Rotunda. Smyly had two sons, one of whom became a member of the medical profession; and one of his four daughters married Dr. Hobhouse of London.

Smyly was educated at Trinity College, Dublin, and at various clinics on the Continent. After an intensive training in obstetrics he became Master of the Rotunda in 1889. In this grand old hospital he soon showed his worth. There was no operating theatre, so he proceeded to collect funds to build a block devoted especially to gynaecological surgery. Obstetrics remained the chief study at the Rotunda, and his inspiring teaching attracted post-graduates and students from all parts of the world. He had much to contend with at the Rotunda; there were no trained maternity nurses, and he was responsible for the expulsion of untrained midwives. He stamped out an epidemic of sepsis; he introduced morphine in the treatment of eclampsia, and his results compare favourably with those obtained in the modern maternity hospitals.

When his term as Master was completed he acquired an extensive private practice and was appointed gynaecologist to the Adelaide Hospital, where he was a successful operator and teacher.

As a man, apart from his profession, Smyly was extremely popular. He had great powers as a raconteur, and was a keen

violinist. He was devoted to charitable works, was a prominent member of the Church body of Ireland, and of numerous other organizations including the Boys' Brigade. He was Senior Grand Warden of the Grand Lodge of Ireland. Although he never wrote a book dealing with obstetrics and gynaecology he contributed largely to obstetrical and gynaecological literature. He attended Lady Dudley while her husband was Lord Lieutenant of Ireland. Honours were showered on him. He received the honour of Knighthood in 1905. He was a Past President of the Royal College of Physicians in Ireland and of many Obstetrical Societies. He was an Honorary Fellow of the Royal College of Obstetricians and Gynaecologists, the Edinburgh and Leipzig Obstetrical Societies, and of the Royal Academy of Medicine in Ireland.

His last "grand tour" was to Peking, where he was the guest of John D. Rockefeller at the opening meeting of the Union Medical College, at which he delivered a lecture.

Sir William Smyly was a keen observer of everything in relation to medical ethics: a good companion, whether he was at a medical meeting, a dinner party, or on a bicycle ride in the country. He will be sadly missed by his professional brethren and by his family, to whom we extend our heartfelt sympathy in their irreparable loss.

BETHEL SOLOMONS.

# Royal College of Obstetricians and Gynaecologists

## Report of the Tetanus Committee

*Adopted by the Council of the College on January 25th, 1941.*

### Appointment of Committee

This Committee was set up in 1939 by the President of the Royal College of Obstetricians and Gynaecologists as a result of a request from the Medical Officer of Health for the London County Council as to the possibility of puerperal tetanus arising from vulval pads used in the puerperium, because it has been shown (Pulvertaft,[1] McIntosh[2]) that wool and cellulose dressings are liable to be heavily infected with *B. tetani* and other spore-bearing anaerobic bacteria.

The following were appointed to the Committee:

Professor W. Fletcher Shaw, M.D., Ch.B., F.R.C.P., F.A.C.S. (Hon.), P.R.C.O.G.
A. C. H. Bell, M.B., B.S., F.R.C.S., M.R.C.O.G.
A. A. Gemmell, M.A., M.D., F.R.C.S. (Edin.), F.R.C.O.G.
G. F. Gibberd, M.B., M.S., F.R.C.S., F.R.C.O.G.
G. W. Goodhart, M.A., M.D., B.Ch., M.R.C.P.
Eardley Holland, M.D., B.S., F.R.C.P., F.R.C.S., F.R.C.O.G.
R. J. Kellar, M.B., Ch.B., M.R.C.O.G.
Professor J. McIntosh, LL.D., M.D., Ch.B.
W. C. W. Nixon, M.D., B.S., F.R.C.S., F.R.C.O.G.

The Committee was asked to investigate the possible importance of surgical dressings as a source of infection with anaerobic bacteria with special reference to the possibility of puerperal tetanus arising from the use of infected vulval dressings, and to make recommendations arising out of the investigation.

### Arrangement of Report

1. The incidence of puerperal tetanus, and gas-gangrene infections.
2. The frequency with which surgical dressings are infected with anaerobic bacteria, and the manner in which they become infected.
3. The evidence that infected dressings may be a source of clinical disease.
4. The methods by which non-infected dressings can be made available.
5. Summary and conclusions.

Appendix I. Details of bacteriological investigations carried out by Professor McIntosh and Dr. Goodhart.

Appendix II. Scheme for the control and supervision of sterilization technique in hospitals.

# REPORT OF THE TETANUS COMMITTEE

1. Tetanus has been recognized as a complication of childbirth from ancient times. It is described by Hippocrates and Aretaeous. "A Synopsis of Difficult Parturition" published by S. Merriman[3] in 1838 gives as an appendix an analysis of 10,190 confinements attended by one physician with one death from puerperal tetanus. J. Y. Simpson[4] wrote an article on tetanus following abortion and parturition in 1854. Of those following labour, in only one patient was he able to record that the confinement was completely normal and without a perineal tear. He comments on the association of plugging the vagina in cases of abortion and the onset of tetanus. Rosenbach described the tetanus bacillus in 1886 and its aetiological *rôle* in the disease was finally proved by Kitasato in 1889. Le Doze,[5] writing in 1936, collected 19 cases of puerperal tetanus from French literature. Fourteen of these followed abortion, and 5 followed delivery at term. He mentions that 3 of the deliveries were uncomplicated and without tears. This author draws attention to the high proportion which follow abortion, and estimates that fatal cases of tetanus following labour and abortion account for 3.5 per cent of all fatal cases due to this organism.

The Committee was not able to obtain recent statistics in relation to non-fatal cases of puerperal tetanus, and the figures which lent themselves to useful analysis fall into two groups; (*i*) those available in the reports of the Registrar-General; (*ii*) those collected from representative institutions with large maternity departments.

(*i*) *The Registrar-General's Figures.* Exactly a century ago (1840) the Registrar-General's Report (the 4th of the series) gives an isolated glimpse of this complication at that time. For that year there were 504,543 registered births, and 2 fatal cases of puerperal tetanus—an incidence of 1 in 250,000. The Registrar-General's figures for the years 1927 to 1937 show that during these 11 years there were 10 cases in which death was recorded as being due to puerperal tetanus, and during the same period there were about 7,000,000 confinements—an incidence of 1 fatal case of tetanus in every 700,000 deliveries.

The incidence of non-puerperal tetanus was also considered by the Committee for the sake of the light it might throw upon the general problem under consideration. During the same 11 years, 1927 to 1937, the total number of deaths ascribed to tetanus averaged 126.6 per annum, and the average population was about 40,000,000. Thus the average death-rate was about 1 in 318,000. Among females, however, the average number of deaths from tetanus each year was 28, and the average female population was about 21,000,000. Consequently the average death-rate from tetanus among females was about 1 in 750,000. If, then, we base our judgment on these figures there is but little difference between the death-rate from tetanus following parturition, and that for the female population as a whole.

Some adjustment is, however, necessary before comparing deaths from puerperal tetanus with those from non-puerperal tetanus, because under the latter heading some cases are lost through being classified with some associated cause. A sample of closely scrutinized cases showed that for every 100 cases recorded as "tetanus" there were about 50 cases in which tetanus

occurred, but which were classified under some other cause. Comparison of the male and female deaths from tetanus shows that these occur in the ratio of 4.5 to 1, so that of the lost 50 cases, 9 would be female. The average number of female deaths from tetanus should, therefore, be reckoned at 30.5, and consequently the corrected female death-rate in the general population is even nearer 1 in 700,000; i.e., the death-rate from tetanus in puerperal cases.

(*ii*) *Figures Collected from Representative Institutions with large Maternity Departments.* Figures were collected for this report from one large group of municipal hospitals (1930 to 1938), from two London voluntary hospitals (1928 to 1937), and from two provincial voluntary hospitals (1928 to 1937). These five units were responsible for 244,562 deliveries in the periods stated. Among these there was 1 fatal case of tetanus.

On the evidence available, therefore, it appears that the risk of death from tetanus following childbirth under present conditions is not significantly greater than the risk of death from tetanus among the whole female population.

In spite of the fact that the risk of tetanus may be very remote, the Committee considered that it was important to investigate the possible part played by dressings as a source of infection, especially as it is so often assumed that cat-gut is the most likely source of post-operative infection. When it is remembered how exacting are the precautions taken to minimize the risk of tetanus infection from cat-gut, it would seem unreasonable not to pay any attention to the possibility of surgical dressings as a source.

An attempt was made to collect evidence about fatal and non-fatal puerperal gas-gangrene infections from the same hospitals which supplied the tetanus data. Unfortunately bacteriological records were insufficient to be of value. From one hospital, however, fairly complete bacteriological records of all puerperal infections were available. In the case of this institution, out of a total of 704 cases of puerperal sepsis there were 2 fatal and 35 non-fatal cases of gas-gangrene infection. There must be very few obstetricians of experience who have not met some cases of this disease, and occasionally a very high incidence of *B. welchii* post-abortum infections has been reported (Hill[6]). The Registrar-General's Report for 1931 to 1938 records an average incidence of 1.625 puerperal deaths from gas-gangrene per annum. It is certain, however, that the incidence is much greater than these figures would suggest, because puerperal gas-gangrene infections are likely to pass undiagnosed, and therefore to be incorrectly certified. It would be misleading on the evidence available to attempt to give a figure for the incidence of gas-gangrene puerperal infections, but it is clear that they are by no means rare. There are many possible sources for *B. welchii* apart from surgical dressings, and the clinical development of an infection is so strikingly associated with the presence of dead tissue (e.g. a macerated foetus) in the uterus, that the part played by infected dressings in the aetiology of the disease is unlikely to be more than a minor one.

2. It has been shown by Pulvertaft and McIntosh that cotton wools and cellulose tissues as ordinarily sold (whether in bulk or made up into dressings

such as vulval pads) are frequently infected with spore-bearing anaerobes including *B. tetani*. A special investigation into samples obtained from various sources was carried out by the Committee (see Appendix I) and the result confirmed the findings of previous investigators: viz. that brown cotton wool is practically always heavily infected with anaerobic bacteria including *B. tetani*: that white cotton wool, though not so heavily infected, is seldom free from spore-bearing anaerobes, and often contains *B. tetani*: that cellulose tissue and the raw material from which it is manufactured are both moderately infected with similar organisms.

Brown cotton wool has not been subjected to any chemical treatment since it left the field upon which it was grown, so that its infection with anaerobes from a heavily manured soil is easily understood, but in the process of manufacture into white wool it is boiled with a strong alkali, and then bleached with an oxydizing agent, which, it would seem, could not fail to destroy all bacteria and their spores. Yet the finished product—white cotton wool—is often heavily infected. In order to find out how this could happen, the process of manufacture was studied in detail. Tests were carried out at all stages in the process of manufacture of white cotton wool for surgical purposes, and it was proved both under commercial conditions and in the laboratory that the bleaching process completely sterilizes the initially infected wool (or in the case of cellulose tissue, the raw material that is imported). The bleached material is then dried by blowing very large volumes of hot air over it. At the end of this drying process it is found to be heavily re-infected with anaerobic organisms. It is obvious, therefore, that the source of the organisms in the final product (white cotton wool or cellulose tissue) is the air which is used for drying. Although there may be relatively few organisms in the air, the material acts so efficiently as a filter for the bacteria, and such large volumes of air are used, that by the time the wool is dry, it has become quite heavily infected.

3. In the present investigation virulence tests were not carried out in every instance when morphological *B. tetani* were isolated, but in two out of three instances when these tests were performed, the organism was found to be of a virulent type.

In assessing the significance of the known facts, the Committee feels bound to conclude that there is nothing improbable in the suggestion that cotton wools and cellulose tissue dressings are a potential source of surgical and puerperal tetanus. In view of their universal use, and of their commonly infected state, they should be viewed with no less suspicion than other possible sources, such as cat-gut.

4. The most logical method of improving the state of affairs in which a material is sterilized at one stage of its manufacture and heavily infected at a subsequent stage, would be to devise some effective change in the manufacturing process. The Committee is not in a position to judge the practicability or otherwise of such a change, although it is obvious that the efficient filtering of the large volumes of air which are used in the drying process must involve great practical difficulties. If it should prove impracticable to keep the bleached cotton wool free from anaerobic spores during the drying

process, the only other alternative would seem to be efficient re-sterilization of the dried material before it is sold to the public for medical and surgical purposes. The sterilization of a large bulk of cotton wool or cellulose tissue involves practical difficulties, and is an additional expense, but neither of these is an insuperable objection.

At the present time, until non-infected cotton wool is commercially available it is necessary for the consumer himself to sterilize it before use for surgical purposes. Although it is easy to destroy the common pyogenic cocci in dressings, nothing less than a rigid technique both rigidly applied and controlled will suffice for the destruction of the anaerobic spore-bearing organisms with which this report is concerned.

An investigation into the current practice of sterilization of dressings in hospitals was carried out by the Committee, and attention was paid particularly to the efficiency of the methods employed in destroying spore-bearing anaerobes. Visits were made to representative institutions. It was found that the technique for sterilizing dressings was likely to be effective in destroying pyogenic organisms, but that there were some instances in which insufficient attention to detail was likely to have rendered the process ineffective so far as spore-bearing organisms were concerned. The Committee considered both the mechanical efficiency of the apparatus in use, and the care with which it was used.

There were but few instances in which unsuitable sterilizing equipment was being used, and in general the apparatus was of a high standard. Although exposure to moderately high temperatures, for relatively short times, may be effective in the destruction of pyogenic bacteria, the destruction of spore-bearing organisms calls for prolonged exposure to higher temperatures in a moist atmosphere. There were cases among the hospitals investigated where these requirements were not always fulfilled. The penetration of moist heat to the middle of a drum of dressings depends a great deal upon the manner in which the drum is packed, and the packing of the drum is not always carried out by a person who is aware of the importance of this detail. In some cases the need for maintaining a high temperature in the autoclave for a definite time was not sufficiently appreciated, and although the apparatus may have been capable of good work, its capabilities were not always used. There were cases in which, although the duration of the sterilizing process and the temperature attained were automatically recorded with modern elaborate apparatus, the graphic record was never subsequently examined by any responsible person. In some cases there was no one responsible person whose duty it was to supervise all the stages of the sterilizing process and to take action if inefficiency was found at any stage. Thus there might be no co-ordination between the person who packed the drums, the person who started the autoclave, and the person whose duty it was to see that the sterilization was complete. In a few instances it seemed to be the duty of no one to reject a batch of dressings if the graphic record (or other indication) suggested faulty technique. Periodical tests of efficiency were not always carried out, and in some instances the tests employed were

of doubtful value. Colour changes in test-capsules placed in the drums cannot be considered satisfactory, because they fail to check all the factors necessary for efficient sterilization. Efficiency depends upon temperature, time, and humidity, and it is doubtful whether there is any substitute for carefully performed bacteriological tests.

The Committee concluded that improvements in existing sterilization practice are likely to come, not so much from improvements in the apparatus used, as from more rigid supervision of all the steps involved in the process.

The Committee wishes to record its thanks to the hospitals and manufacturing firms which have so kindly supplied information necessary for the investigation. To Messrs. Southall's the Committee is particularly indebted for much valuable help and expert information; the courtesy of their Managing Director and Chief Chemist in giving facilities for a large part of the investigation has been very greatly appreciated. Dr. Percy Stocks of the Registrar-General's Department placed his special knowledge at the disposal of the Committee, and his help is most gratefully acknowledged.

5. Bacteriological investigations made by the Committee amply confirm the findings of previous workers that cotton wools and cellulose tissues, as supplied to the public for surgical purposes, are generally heavily infected with spore-bearing anaerobic bacteria, and that among these bacteria virulent strains of *B. tetani* are not infrequently found. As there are many other possible sources of infection with *B. tetani* in the puerperium and after surgical operations, it is not possible to be certain of the part played by dressings in the aetiology of clinical tetanus, but there is not any reason to exempt dressings from suspicion when an unexpected case of tetanus does occur. Indeed, the almost universal use of wool or cellulose in the puerperium or after operation; the almost constant presence of large numbers of anaerobic bacteria in these materials as supplied to the public, and the difficulties of destroying these bacteria by anything less than carefully controlled sterilization, make it probable that these dressings are as important a source of surgical and puerperal tetanus as other recognized sources such as cat-gut.

It is certain that puerperal tetanus is an extremely rare disease but the rarity of the disease is no justification for tolerating the use of dressings which we know to be a potential source of infection. The meticulous care that is insisted upon during the preparation of cat-gut for surgical purposes, and the stringency of the tests which are demanded before it can be supplied to the public, are counteracted so long as infected cotton wool and cellulose dressings are sold for surgical purposes with complete indifference to their possible content of *B. tetani*.

The Committee has come to the conclusion that a complacent attitude in this matter is not justifiable, and it recommends that cotton wools and other materials should not be used for medical and surgical purposes unless they have been efficiently sterilized. The responsibility for this sterilization ought, it would seem, to rest with the manufacturer who markets the material. The Committee recommends that the sterilization of all materials

used for surgical dressings should be carefully supervised and scrutinized, so that the process may be efficient in the destruction of all spore-bearing organisms.

## Appendix I.

### Bacteriological Report

by

Dr. G. W. Goodhart and Professor J. McIntosh.

*(a) Bacteriological Examination of Samples of Cotton Wools and Wood Pulp (Cellulose Tissue).*

Test No. 1.

| Cotton wool samples | Aerobes | Anaerobes | | |
|---|---|---|---|---|
| | Cocci, B. subtilis, B. coli, etc. | B. welchii | Sporogenes | B. tetani |
| A | + | + | + | + |
| B | + | + | o | o |
| C | + | o | o | o |
| D | o | + | o | o |
| Wood pulp | | | | |
| E | + | + | o | + |

A. Brown cotton wool (unbleached) used for making bleached and unbleached cotton wool.

B, C, and D. White cotton wool used for preparation of "Sterilized dressings."

E. Sulphite wood pulp used for cellulose wadding.

Test No. 2.

| Sample | Aerobic bacteria | | Anaerobic bacteria | | | |
|---|---|---|---|---|---|---|
| | Cocci, B. subtilis, B. coli, etc. | B. sporogenes | B. welchii | Oval terminal spores | Round terminal spores | B. tetani |
| A | + | + | + | o | + | – |
| B | + | o | o | + | o | – |
| D | + | o | o | o | + | – |
| E | + | + | o | + | + | – |
| K | + | o | o | o | o | – |
| L | + | o | o | + | + | – |

A and B—soda pulp: Boiled with caustic soda and then bleached.

D and E—bleached sulphite wood pulp: Boiled in solution of calcium bisulphite and bleached.

K and L—the same as D and E, but unbleached.

The bacteriological examinations showed that all the samples of cotton wool and wood pulp were contaminated with sporing bacteria both aerobic and anaerobic.

Culturally proved *B. tetani* were isolated in test No. 1 from Sample A cotton wool and sample E of wood pulp, while in test No. 2 anaerobic bacteria with round terminal spores, morphologically resembling tetanus, were isolated: but pathogenic effects were not observed on test.

It is thus evident that commercial cotton wool and wood pulp is heavily contaminated with spore-bearing anaerobes which not infrequently include pathogenic forms.

(*b*) *The source of Anaerobic Contamination of Manufactured Cotton Wool.*

The initial bacteriological investigations confirmed that white cotton wool as well as the brown was very frequently contaminated by sporing anaerobic bacteria and that pathogenic forms were often present.

In order to find the actual source of anaerobic contamination in the manufacture of white cotton wool, the process was gone into very carefully.

The process of manufacture of white cotton wool is much as follows:

1. The raw material is boiled for several hours (the time varies a good deal), often under pressure, with solutions of caustic soda, about 1 per cent. Sometimes lime solutions are employed at first, but the process is variable in details and always includes prolonged boiling in alkali.
2. The material is then washed in water for a number of hours.
3. It is then soaked in a bleaching solution of hypochlorite containing about ½ per cent available free chlorine.
4. The material is again well washed in water.

A large series of experiments was set up to test the efficiency of the process of manufacture under conditions similar to those in the factory. The disinfecting effects of heat, hot alkali and chlorine, either alone or combined, are given in Table I. The experiments clearly showed that the bleaching process employed in the course of manufacture is amply sufficient to sterilize the cotton wool completely of all bacteria, both aerobic and anaerobic.

It is thus apparent that a reinfection (contamination) of the cotton wool must take place after the process of bleaching has been finished. In order to trace this possibility samples of cotton wool were obtained from the various stages of manufacture:

1. Wet cotton wool after bleaching.
2. Cotton from the end of the drier.
3. Cotton which has been through the scutcher, i.e., from the lap ready to put on the carding machine.
4. Cotton when carded.

The results of the bacteriological examination of these stages are given in Table II. This showed that after treating with chlorine (Stage 1) anaerobic bacteria or sporing bacteria were not found at this stage, but numerous cocci were found in the wool, apparently derived from the water used to wash the excess of chlorine away. Examination showed that this was due to a contamination of the Artesian well water by the water softener. With regard to Stage 2 (after drying) in which large quantities of hot air are blown through the cotton wool, both sporing anaerobes and aerobes were found present in the wool. This apparently is the stage at which contamination with anaerobic bacteria takes place during manufacture. The cotton wool simply acts as a filter and collects all the microbes from the air which is blown through. Increased contamination was noted after Stages 3 and 4.

It appears therefore most likely that the contamination with anaerobic bacteria is caused by the blowing of a large volume of air heavily contaminated with anaerobes through the cotton wool in the process of drying.

The aerial contamination is due to the fact that the intakes to the blower fans are very close to the floor and thus suck up large amounts of dust which is heavily contaminated with anaerobic spores from the crude cotton wool and dirt from the street.

*Conclusion*: It thus appears that the preliminary process of manufacture is sufficient to sterilize cotton wool but subsequent bacterial contamination occurs in the final processing.

TABLE I.

DISINFECTANT EFFECT OF HEAT, ALKALI AND CHLORINE ON COTTON WOOL HEAVILY INFECTED WITH ANAEROBIC BACTERIA.

| Sample No. | Time | Anaerobic growth |
|---|---|---|
| **HEAT (Water at 100 to 105°C.)** | | |
| 1. | 60 minutes | + |
| **ALKALI (1 per cent NaOH at 100 to 105°C.)** | | |
| 2. | 30 minutes | + |
| 3. | | + |
| 4. | 60 minutes | + |
| 5. | | − |
| 6. | 3 hours | + |
| 7. | | − |

TABLE I (*continued*).

| CHLORINE (½ per cent free) | | |
|---|---|---|
| Sample No. | Time | Anaerobic growth |
| 8. | 30 minutes | + |
| 9. | | + |
| 10. | | + |
| 11. | | + |
| 12. | 60 minutes | + |
| 13. | | + |
| 14. | | + |
| 15. | | + |
| 16. | 3 hours | + |
| 17. | | + |
| 18. | | – |
| 19. | | – |

HEAT FOLLOWED BY CHLORINE.

| Sample No. | Time of water at 100 to 105°C. | Time of chlorine | Anaerobic growth |
|---|---|---|---|
| 20 | 60 minutes | 60 minutes | – |
| 21 | 60 minutes | 3 hours | – |

HEAT AND ALKALI (1 per cent NaOH at 100 to 105°C.) followed by chlorine.

| Sample No. | Time of alkali at 100 to 105°C. | Time of chlorine | Anaerobic growth |
|---|---|---|---|
| 22 | 30 minutes | 30 minutes | – |
| 23 | 60 minutes | 60 minutes | – |
| 24 | 60 minutes | 3 hours | – |

All samples were washed in sterile distilled water between each manipulation:

After NaOH until the washings gave *p*H 7.0 to 7.6; after chlorine until the washings appeared free of all traces of chlorine to smell.

TABLE II.

BACTERIOLOGICAL EXAMINATION OF COTTON WOOL AT DIFFERENT STAGES OF MANUFACTURE.

| Sample | Cocci | Subtilis | Anaerobes | Bacteria per gram of wool |
|---|---|---|---|---|
| Cotton after bleaching (Stage 1) | + | — | — | 12,500 |
| Cotton after drying (Stage 2) | + | + | + | 50 |
| Cotton from scutcher (Stage 3) | + | — | + | 450 |
| Carded cotton (Stage 4) | + | + | ± | 200 |

BACTERIOLOGICAL EXAMINATION (BACTERIAL COUNT) OF WATER.

| Sample | Bacteria per 100 c.c. |
|---|---|
| Water direct from deep well .... ... ... ... | 2 |
| Water after passing through softener ... ... | 260,000 |

Anaerobic bacteria not isolated.

## APPENDIX II

### SCHEME OF GENERAL INSTRUCTIONS FOR THOSE RESPONSIBLE FOR STERILIZING DRESSINGS IN HOSPITALS

There are three important factors in the sterilization of dressings by steam under pressure; these are heat, moisture and time. It must be borne in mind that this sterilization depends not so much on the maximum temperature employed as on the complete permeation of the dressings by moist steam. In order to effect this, air must be removed by vacuum before the steam is turned on. This ensures that air pockets will not remain to block the penetration of steam. For the same reason dressings must be packed loosely in the containers or bags, and for the above reasons the containers or bags must be correctly designed, and towels and gowns be dry at the time of packing.

It is also important that cleanliness be maintained in the handling of the sterilizing containers, as contamination through improperly closed steam vents can easily take place. The operator should always wear a clean overall or gown.

### DETAILS TO BE SUPERVISED

1. PACKING.

(*a*) ***Metal containers, etc.*** To ensure that the sterilization of dressings shall be complete the packing of the containers must be done in such a way that the dressings will be easily permeated by the steam. In all instances, therefore, the dressings must be packed loosely but never pressed down; this

## CORRIGENDA

### Royal College of Obstetricians and Gynaecologists
### Report of the Tetanus Committee

Since going to press the following corrections have been received:

Page 405:

2 (*b*) *For* 20 to 25 inches *read* 15 to 20 inches.

2 (*d*) *For* 20 inches *read* 15 to 20 inches.

applies equally to gowns and towels. Further, cotton wool when in any quantity should be unrolled and dealt with in loose layers. On the other hand waterproof sheeting must be interlayered with towels and folded as little as possible.

(*b*) *Bags*. A special warning is indicated when the dressings have to be packed in linen bags, as in many hospitals at the present time suitable metal containers are unobtainable. The dressings must be packed loosely in such a way that when the bag is closed it does not bulge, while in the sterilizer these bags must be put individually on racks and never stacked in heaps.

(*c*) *Rubber gloves*. These require special treatment both in the way of packing and sterilization. The gloves after having been cleaned properly should be packed flat, with each glove between a layer of gauze, and then placed loosely in the containers. To prevent vulcanization of the gloves these should be sterilized at a lower temperature, i.e., 105°C. *for* 15 *minutes*. Gloves, therefore, cannot be sterilized with ordinary dressings without serious damage.

2. STERILIZATION.

(*a*) Linen bags when put in the sterilizer should be placed on trays, and not stacked in heaps. Open vents in metal containers and immediately place in autoclave.

(*b*) Evacuate the sterilizer to a negative pressure of 20 to 25 inches of mercury, and hold this for 5 minutes before steam is turned on for sterilization.

(*c*) Close the vacuum valve and turn on the steam until the pressure gauge reads 20 pounds pressure, adjust the steam valve and hold this pressure for 20 minutes.

(*d*)* Evacuate to a negative pressure of 20 inches of mercury for 15 minutes at conclusion of sterilization. (This serves to dry the contents after the sterilizing process is finished.)

(*e*) Close vents in containers immediately after removal from the autoclave.

(*f*) When the sterilizing apparatus is fitted with an automatic pressure recording device examine the record and if it is satisfactory release the container for use.

---

* Since the adoption of the Report by the Council of the Royal College of Obstetricians and Gynaecologists, the following additional recommendation has been added at the suggestion of the Medical Officer of Health for the London County Council:

The air must be admitted *very slowly* to the sterilizer, taking at least 10 minutes in the process. The air should be drawn through a thick layer of sterile cotton wool on its way to the interior of the sterilizer. The sterile cotton wool should be renewed each time the sterilizer is used.

3. Record Keeping.

Write the date and number of the batch on the drum to which it relates; preserve the record for future reference and inspection by the department of the hospital which is responsible for the supervision of sterilization.

When the sterilizing apparatus is not fitted with an automatic pressure recording device, note in a book the duration and amount of negative pressure attained, and the duration and amount of the positive pressure of steam subsequently attained.

### Periodical Tests of Efficiency

A bacteriological test with spore-bearing anaerobes should be made at monthly intervals. Chemical tests are unreliable.

### Bibliography

1. Pulvertaft, R. J. V. *British Medical Journal*, 1937, i, 441.
2. McIntosh, J. *Middlesex Hospital Journal*, July, 1937.
3. Merriman, S. "A Symposium of Difficult Parturition," London, 1838, p. 339.
4. Simpson, J. Y. *Monthly Journal of Medical Science*, 1854, xviii, 97.
5. Le Doze, F. *Thèse Paris*, 1936, No. 542.
6. Hill, A. M. *Journal of Obstetrics and Gynaecology of the British Empire*, 1936, xliii, 201.

# Review of Current Literature

*Director*: FREDERICK ROQUES, M.A., M.D., M.Chir. (Cantab.), F.R.C.S., F.R.C.O.G.

THIS Review contains the lists of contents and abstracts of the more important articles from the journals with which the "Journal of Obstetrics and Gynaecology of the British Empire" exchanges.

The Review of Current Literature has kept the readers of the Journal in touch with current literature throughout the world; owing to the war many journals with which the *Journal of Obstetrics and Gynaecology* previously exchanged are no longer received. At the end of the year an Index of all the subjects contained in the articles of the journals reviewed is printed. Arrangements are also made to include abstracts of important articles on border-line subjects, such as Physiology, Biology, and Biochemistry.

LIST OF ABSTRACTORS

J. LYLE CAMERON, F.R.C.S.; W. E. CROWTHER, M.B.; R. H. B. ADAMSON, M.D.; B. JEAFFRESON, F.R.C.S.; P. MALPAS, F.R.C.S.; T. N. A. JEFFCOATE, F.R.C.S.; MEAVE KENNY, F.R.C.S.; JANE H. FILSHILL.

## The Lancet

September 14th, 1940.

*Post-partum necrosis of the anterior lobe of the pituitary. H. L. Sheehan.

October 5th, 1940.

*Treatment of chronic mastitis. H. J. B. Atkins.

October 19th, 1940.

*Androgen and pregnandiol excretion in hypertrichosis. Raymond Greene.

November 30th, 1940.

*Menorrhagia due to essential thrombocytopenia. Linton Snaith.

POST-PARTUM NECROSIS OF THE ANTERIOR LOBE OF THE PITUITARY.

Sheehan reports 10 further cases of recent or healed necrosis of the pituitary in order to emphasize the importance of haemorrhage and shock in the aetiology of this lesion. These 10 cases of pituitary necrosis were found in a series of 95 obstetric autopsies. In this series 52 of the patients had no collapse or significant haemorrhage, and none of them showed any

fresh lesions in the gland. The remaining 43 patients had varying degrees of collapse and haemorrhage, and 33 of them died within 14 hours of the delivery. These 33 cases had not had time to develop any definite necrosis, but several of them showed a peculiar histological appearance in the anterior lobe of the pituitary; the parenchyma cells, while otherwise normal, had become separated *en masse* from the inter-alveolar septa. The author concludes that it was a sign of incipient necrosis. It was not due to variations in fixation or to post-mortem changes as the examination was always made within two hours after death.

The remaining 10 patients, who had had haemorrhage, or collapse at delivery, died later in the puerperium. Of these, two had been desperately ill from this cause, and in both was there massive necrosis of the anterior lobe. In neither of them did the breasts show any evidence of lactation and the author is of the opinion that, had they lived, they would certainly have developed Simmonds's disease. The 8 others had moderately severe collapse or haemorrhage at delivery, but had not been so seriously ill; 4 of these had small necroses of the pituitary, and the other 4 had none. However, these 4 cases showed small areas of old healed necrosis, the result of haemorrhage in a previous pregnancy. From a study of these cases Sheehan is convinced that severe obstetric shock or haemorrhage causes varying degrees of necrosis of the anterior lobe of the pituitary, and that this necrosis is the aetiological factor in the development of Simmonds's disease.

### Treatment of Chronic Mastitis.

When the chronic mastitis clinic was established in 1937 at Guy's Hospital, Atkins examined the effect of oestrogens, prescribed as oestradiol benzoate injections or oral stilboestrol. He treated 33 cases and, of these, 15 were rendered worse, amelioration was claimed by only 4, and 14 were unchanged. The clinical picture was controlled by histological biopsies but the changes after treatment were neither sufficiently constant nor sufficiently extensive for any conclusion to be reached.

He then investigated the effect of the administration of such androgens as testosterone propionate. He treated 34 patients with the drug given by injections, in doses usually exceeding 400 mgm., for four weeks. Among these 34 patients, 25 were benefited so far as the breast condition was concerned, but hairiness, amenorrhoea and deepening of the voice were noted in 8, and disturbance of menstruation was observed in others. Histological investigation was undertaken in 21 cases. The changes were slight, but on the whole some of the features of chronic mastitis appeared less advanced in most of the sections taken. In one case, the only one of 212 to become malignant, carcinoma of the breast developed 10 months after a course of injections of testosterone propionate.

### Androgen and Pregnandiol Excretion in Hypertrichosis.

Raymond Greene describes the case of a woman of 26 who had begun, at the age of 19, to show an excessive growth of hair. Estimations of

the excretion of androgens and of pregnandiol were performed. The excretion of 17-ketosteroids was found to be above the usual limits for a normal woman, and sometimes exceeding double this figure. From this, apart from the clinical evidence, it was assumed that there was some degree of hyperplasia of the adrenal cortex. As no patient with an adrenal tumour, confirmed by operation or post-mortem examination, had given a figure less than three times the normal excretion, it was decided not to operate. The excretion of pregnandiol was found to be absent; so it was assumed that ovulation was not taking place, and that the hypertrophied adrenals were not secreting this substance. A relation between the adrenal glands and progesterone metabolism has been shown by a number of observations.

MENORRHAGIA DUE TO ESSENTIAL THROMBOCYTOPENIA.

In this paper Linton Snaith describes a case of menorrhagia in a woman aged 27 years which finally was found to be due to thrombocytopenia. Her uterus was curetted and the endometrium did not show any evidence of abnormal endocrine influence. At this time there was only 50,000 platelets per c.mm. Medical treatment with iron, etc., was carried out but there was no permanent improvement. After a return of prolonged and heavy floodings, splenectomy was performed. The spleen was found to be more than twice its normal size and three days after the operation the platelet count soared to 300,000.

BRYAN L. JEAFFRESON.

---

## British Medical Journal

Vol. ii, July 13th, 1940.

*Transfusions of fresh and stored blood. H. F. Brewer, M. Maizels, J. O. Oliver, and Janet Vaughan.

Vol. ii, July 20th, 1940.

*Preserved blood: an analysis of its use. F. R. Edwards and T. B. Davie.

Post-operative pulmonary complications. B. N. Sircar and F. K. Boston.

Vol. ii, July 27th, 1940.

*The use of plasma or serum as a substitute for whole blood. C. H. Best and D. Y. Solandt.

Vol. ii, August 10th, 1940.

Pulmonary embolism and infarction. B. Parsons-Smith.

Vol. ii, August 17th, 1940.

*Osteomalacia and placental caries. G. F. Taylor and C. D. Marshall Day.

Vol. ii, August 24th, 1940.

*Serum and plasma in the treatment of haemorrhage in experimental animals. J. W. Magladery, D. Y. Solandt, and C. H. Best.

Vol. ii, September 28th, 1940.

*A case of combined extra-uterine and intra-uterine pregnancy. Jean Herring and Abigail Lesslie.

Vol. ii, October 5th, 1940.

*A maternity hospital at the home front. Margaret Basden.

Vol. ii, October 26th, 1940.

*The diagnostic value of pregnandiol excretion in disorders of pregnancy. C. L. Cope.

Vol. ii, November 2nd, 1940.

*Dysmenorrhoea and sterility: personality studies. E. Wittkower and A. T. M. Wilson.

Vol. ii, December 7th, 1940.

*J. Marion Sims and the vesico-vaginal fistula: then and now. Chassar Moir.

*The repair of a vesico-vaginal fistula by a new technique. J. B. Macalpine.

The vesico-vaginal fistula. (Editorial.)

Vol. ii, December 14th, 1940.

*A note on the transfusion of re-constituted dried human serum. H. A. Brown and P. L. Mollison.

Imperfect sterilization of dressings as a probable cause of post-operative tetanus. S. N. Hayes.

*Lactation and breast feeding. William Hunter.

Vol. i, January 4th, 1941.

*A contribution to the study of human fertility. John Pryde.

*Transplacental tuberculous infection. Monica Davin-Power.

TRANSFUSIONS OF FRESH AND STORED BLOOD.

Fresh blood is defined as that which is transfused within 24 hours of collection, whereas stored blood is kept for 10 to 14 days before transfusion. Two parts of blood were added to one part of preserving fluid consisting of 3.0 per cent glucose in 0.85 per cent sodium chloride, and 1.05 per cent sodium citrate. One hundred and fifty-three transfusions are reported. Stored blood produced clinical improvement in the patients as frequently as did fresh blood, although the rise in haemoglobin in patients suffering from haemorrhage was not always so great.

There were no serious reactions manifested by jaundice or haemoglobinuria. Minor reactions, however, are common when stored blood is used. The incidence of reactions does not depend on the amount of blood used or the rate of transfusion, although there is some evidence that it may be lowered by warming the blood before transfusion.

PRESERVED BLOOD: AN ANALYSIS OF ITS USE.

This report deals with the first 1,500 bottles of blood collected by the Merseyside War Blood Bank. Each bottle contains 405 c.c. of blood and 45 c.c. of 3.8 per cent sodium citrate. The bank supplies blood for all the transfusions in the district, and the rate of transfusion is twice as good as in pre-war times. The apparatus for collecting and transfusing blood is described.

9.07 per cent of bottles were wasted on account of haemolysis or accident. Blood was not used later than 21 days after collection, and the average duration of storage was 7 days.

The number of reactions was not greater than when fresh blood was employed, but the severity of the reaction was influenced by the age of the blood, and the use of blood within 10 days of collection is advisable. Reactions also depend on the disease for which transfusion is given. Five per cent of patients had grade III reactions. There were 5 cases of haemoglobinuria, 7 of jaundice and one case of generalized urticaria.

Five patients died during transfusion and 71 died within 12 hours of transfusion. In none was there evidence that the transfusion contributed to the fatal result. 87.5 per cent of patients showed clinical improvement as a result of transfusion.

Preserved blood gives excellent results in cases of acute haemorrhage, chronic secondary anaemia and shock; but fresh blood is preferable for cases of dyshaemopoietic anaemias, and for anaemia associated with sepsis. For the latter, complement and antibodies are important, and these quickly disappear from stored blood. The prothrombin level of stored blood also falls quickly, so it is of little value in patients suffering from jaundice.

Stored blood is of particular value for acute haemorrage and shock, although plasma may prove of equal or greater value in the latter. Any disadvantages are more than compensated by the fact that stored blood is always available, and can be given without delay.

THE USE OF PLASMA OR SERUM AS A SUBSTITUTE FOR WHOLE BLOOD.

The writers discuss the relative values of plasma and serum for transfusion purposes. The fibrinogen content of plasma is not particularly advantageous and, therefore, serum produces equally good effects.

With regard to reactions, however, some writers have had more trouble when using dried serum than when using dried plasma. The writers have not experienced this and continue to employ both dried serum and dried plasma, regarding them as being of equal merit for transfusion.

OSTEOMALACIA AND DENTAL CARIES.

In previous work the authors showed that children with proved and extensive rickets had excellent teeth. Diets deficient in calcium, phosphorus and fat-soluble vitamins, and rich in cereals do not necessarily result in dental caries.

During a recent visit to the Kangra district of the Punjab, 22 cases of osteomalacia in women were studied. The disease was severe in all cases, and tetany had occurred in 8 patients. The majority had a history of difficult and complicated confinements. These women take a diet rich in carbohydrate, with very little protein and fat. They rarely eat meat and vegetables. The osteomalacia was due to dietetic deficiencies often associated with frequent pregnancies and prolonged breast feeding.

Yet these women were practically free from dental caries. Many had pyorrhoea. Moreover, 7 children of these mothers were studied. All had rickets, but their teeth were in good condition.

The common assumption that pregnancy increases a patient's susceptibility to dental caries is not substantiated, and further enquiry is indicated. Calcification and decalcification of the osseous system is not related to dental caries.

SERUM AND PLASMA IN THE TREATMENT OF HAEMORRHAGE IN EXPERIMENTAL ANIMALS.

Fifty-five dogs were bled, and it was found that the weight of the animal and its initial blood-pressure played no part in determining the amount of bleeding required to produce features of shock. No animal losing more than 55 per cent of its calculated blood-volume recovered without treatment.

Various remedies were assayed after the animal had been bled to a point when early death was inevitable. Isotonic saline, hypertonic saline and glucose solutions produced a fleeting rise in blood-pressure, but had little value as blood substitutes in these experiments.

Ten animals were treated by restoration of their own heparinized blood. At least 40 per cent of the blood removed was necessary to secure recovery in cases of well-established post-haemorrhagic shock. Similar results were obtained with plasma and serum.

Concentrated serum, which has previously been shown to be useful in the treatment of traumatic shock, produced no better results than did isotonic serum in these cases of haemorrhagic shock.

In all cases the best results were obtained by rapid transfusion, i.e., 50 to 100 c.c. per minute. The longer the delay in initiating treatment the less effective that treatment is. Serum and plasma transfusions were as beneficial as blood transfusions in these animals.

CASE OF COMBINED EXTRA-UTERINE AND INTRA-UTERINE PREGNANCY.

The patient, aged 35, had had 4 previous pregnancies. Five weeks after the last menstrual period, she developed typical symptoms and signs of ectopic gestation. Operation revealed a left tubal pregnancy with blood-clot around the abdominal ostium. The uterus was slightly enlarged and tense. Left salpingectomy was followed by complete recovery.

One month after leaving hospital, the patient reported that she was

still pregnant. She was examined three months after the operation and was found to be 4 months pregnant. The pregnancy progressed normally, and the subsequent confinement was uncomplicated. The last menstrual period commenced on June 15th, 1939, the operation for ectopic gestation was carried out on July 20th, and the baby, weighing 8 pounds, was born on April 4th, 1940.

A Maternity Hospital at the Home Front.

This article deals with the work at the Mothers' Hospital, Clapton, during war-time. The hospital contains 100 beds in a series of one-storey bungalows. The air-raid shelter, equipped with running water, heat and light, and facilities for serving hot drinks, is sufficiently large to accommodate all the patients and staff.

The patients are allowed out of bed for a few minutes the day after confinement and thereafter a little longer each day. Abdominal operation cases, including Caesarean section, get up on the 5th day. The patients are thus happier and free from any feeling of helplessness in the event of emergency. Moreover, there has been a decrease in morbidity-rate, less venous thrombosis and the patients are stronger at the time of returning home. During air raids, the patients walk to the shelter each with her baby, respirator and spare blanket. Only a few are stretcher or chair cases and can easily be moved by the staff: stretcher cases are nursed with a canvas stretcher already in position. All are in the shelter within 7 minutes of an alarm.

With the increasing number of night raids, all patients except those within two hours of delivery are taken to shelter every night, but there is room only for the most recently delivered women to lie down. The remainder sit down and the babies are accommodated on shelves. Labours are conducted in a reinforced theatre in one of the hospital blocks.

The staff, too, sleep on mattresses on the floor of the shelter. So far there is no sign that either patients or staff are feeling the strain. There is no evidence that the reduction in length of the lying-in period has any immediate bad effect. It may increase the incidence of subsequent prolapse but such risks have to be taken in the present circumstances.

The Diagnostic Value of Pregnandiol Excretion in Pregnancy Disorders.

Over 100 cases of pregnancy were studied, and of these 75 were pathological. The pregnandiol was extracted from the urine in the form of sodium pregnandiol glucuronidate and weighed. The results are expressed in weight of pregnandiol (i.e. 320/536 of the complex form). Venning's butyl alcohol extraction method was used. The concentration of pregnandiol in any one sample of urine is of little significance; the total output of the substance over 24 hours should be measured. During the luteal phase of the normal menstrual cycle, the total output varies from 3 to

60 mgm. The maximal excretion (1 to 6 mgm. daily) occurs 5 to 7 days before menstruation. During the first few weeks of pregnancy the excretion of pregnandiol does not exceed that of the peak of the luteal phase of the menstrual cycle. The maximal output occurs in the last two months of pregnancy. Pregnandiol can no longer be demonstrated in the urine a few days after parturition.

During the last 6 weeks of pregnancy, the daily excretion varies from 30 to 110 mgm., the average being 55 mgm. There are wide variations within normal limits and, therefore, assays do not need to be very accurate for clinical purposes.

The estimation of pregnandiol in the urine may prove of value in the diagnosis of pregnancy but the demonstration of pregnandiol in the urine of a patient complaining of amenorrhoea does not necessarily mean she is pregnant: a menstrual period might be impending. Also, the failure to find pregnandiol in the urine does not mean that pregnancy can be excluded.

In cases of threatened abortion, a negative pregnandiol test on at least two occasions usually means that either abortion is complete or inevitable, or the products of conception are dead. If pregnandiol is demonstrable in the urine of such cases the amount present is of no value in making a prognosis. Cases of incomplete abortion give a negative pregnandiol test.

In the diagnosis of death of the foetus, the test is of more value, although again a positive finding is of no significance. In 20 proved cases, the readings became negative in 9.

Chronic nephritis and toxaemia of pregnancy interfere with pregnandiol excretion so that negative results are sometimes obtained. However, in a series of 10 cases of toxaemia, normal pregnandiol output is recorded.

The comparative values of pregnandiol estimations and the Zondek-Aschheim test in the diagnosis of pregnancy and chorion-epithelioma are discussed.

DYSMENORRHOEA AND STERILITY: PERSONALITY STUDIES.

A group of patients was investigated from the standpoint of environment, childhood characteristics, reactions to adolescence, and adult personality. There were 57 cases of primary dysmenorrhoea, the patients varying in age from 16 to 40. Thirty patients suffered from sterility for which no cause had been found. A control group of 30 primigravidae, free from dysmenorrhoea, was also investigated. Patients with dysmenorrhoea fall into two groups.

1. *Those showing resentment of the female role.* These are hard and aggressive, with a tendency to masculinity. They are tomboys in youth and frequently athletic. They resent menses which interfere with athletic and other pursuits. In some cases they are attracted to the opposite sex, but they enjoy the comradeship of men and dislike any attempt at courtship.

2. *Those who are shy and plaintive.* These patients have a juvenile

physique, are shy and timid throughout life, have a feeling of inferiority, and are often jealous of others more successful in life. They are over-attached to parents who may have spoiled them in childhood. Some illness in childhood may determine their adoption of the attitude of the plaintive invalid throughout life.

Patients suffering from sterility are mostly those of the second type. They tend to be infantile in body and mind, and rarely possess fully developed adult sexual feelings.

Neurosis, anxiety and overwork are usually regarded as factors causing dysmenorrhoea. The authors consider that these personality factors are often the primary cause, and they may act through an autonomic-endocrine disturbance.

Also, such emotional factors may influence conception by interfering with orgasm, vaginal secretion, vaginal peristalsis, and even ovulation.

J. Marion Sims and the Vesico-vaginal Fistula: Then and Now.

Sims began his pioneer work on vesico-vaginal fistula 95 years ago, in a hut which housed 7 negro women slaves. Following his appreciation of the value of the genupectoral position, and later the Sims's position, for obtaining good exposure of the fistula, he devised instruments and attempted repair of a condition previously considered incurable. For 4 years all his operations failed in spite of every modification of technique. Finally, he used silver wire to close the vesical defect and he obtained his first success on a patient on whom he had previously operated unsuccessfully on 30 occasions. Following this, he continued his work in spite of ill health and became more and more successful.

Apart from his fistula work, Sims was responsible for founding the first hospital devoted to the treatment of diseases of women. He described the fertile period in the menstrual cycle and carried out the first successful artificial insemination for sterility.

Vesico-vaginal fistulae are now less common and surgeons have correspondingly less experience in their surgical treatment. There is a modern tendency to neglect the vaginal approach and to undertake more complicated abdominal operations. But the technique devised by Sims has much to recommend it and in fact it is possible, by its means, to close even the largest type of fistula.

Three difficult cases of fistula successfully treated after the manner of Sims are described. The author uses silver wire as suture material, particularly for fistulae high in the vagina. The Sims's or knee-chest position is used for the operation and the patient is subsequently nursed in the prone position with continuous bladder drainage. Careful post-operative treatment is essential if good results are to be obtained.

The Repair of a Vesico-vaginal Fistula by a new Technique.

In the case described, the fistula was the result of injury to the bladder during hysterectomy. It was large and situated high in the anterior

wall of the vagina. An abdominal transvesical approach was used and the vagina divided below the level of the fistula. The upper vagina was then closed so that it served as the posterior portion of the bladder. Finally, the vaginal walls were sutured below the fistula to form a new vaginal vault. Continuous suprapubic drainage was employed post-operatively. The operation was completely successful and subsequent cystoscopy revealed that the vaginal epithelium had taken on the appearance of the rest of the lining of the bladder.

In this operation, healthy tissue flaps are employed instead of the infected fibrous tissue which surrounds a fistula's opening. It may be possible to modify the flaps to permit uterine drainage for those cases in which the uterus has not been removed.

A Note on the Transfusion of Re-constituted Dried Human Serum.

There is a difference of opinion as to the relative merits of serum and plasma for transfusion purposes. Serum is said to produce more reactions. The method of preparation of the serum may explain the reported discrepancies in results.

This article deals with the results of transfusions of dried serum prepared by the Medical Research Council's serum drying unit at Cambridge. After passing through a Seitz filter, the serum is dried from a frozen state, *in vacuo*. Ninety-one transfusions are reported; in 44 of these, the indication was shock or acute haemorrhage. The serum was mostly injected in a four-times concentrated form. This makes a viscid solution which has to be injected under pressure.

Twenty-one out of 44 cases showed definite improvement and the largest doses gave the best results. No patient had a fall in blood-pressure after transfusion.

In 91 transfusions, mild reactions occurred in 18 patients. Concentrated serum is more likely to produce lumbar pain, and is difficult to dissolve and inject, so that only twice concentrated serum will probably be of more practical value.

Apart from their personal cases, the total serum transfusions carried out with material from the Cambridge Laboratory number 202. In all these, 34 mild reactions were recorded. This number compares favourably with the reactions noted in 30 cases in which liquid citrate plasma was employed.

It is concluded that serum as supplied by the Cambridge Laboratory is not toxic and produces no more reactions than does plasma. It is of value in the treatment of shock but not less than the equivalent of 400 c.c. of serum should be used.

Lactation and Breast Feeding.

Breast milk has a composition best suited to the baby, is administered in practically sterile form and at the right temperature. Lactation is advantageous to the mother. Breast feeding is contra-indicated by (1)

severe maternal illness, (2) breast infection, (3) puerperal insanity, (4) another pregnancy, (5) absence of milk in the breasts.

The inhibiting action of oestrin and progesterone disappears after parturition, and the anterior pituitary secretes the lactogenic factor, prolactin. This, assisted by thyreotropic factors and possibly vitamin E, initiates lactation which is subsequently maintained by the sucking reflex.

During the antenatal period, the nipples should be washed daily and anointed with an emollient. Spirit preparations should not be used.

The technique of breast feeding is described, and the total 24-hour intake of a baby 7 to 10 days old should be 2½ ounces for each pound of body weight. Underfeeding on the part of the baby results in dehydration, constipation, fretfulness; the cause may be maternal or infantile. If the child is lazy during feeds, it may be given ½ N. saline before meals to make it thirsty.

An inadequate supply of breast milk should be treated by general dietetic and hygienic measures. The mother should have adequate rest and freedom from anxieties. Lactogol, vitamin E, and prolactin are also advised and thyreotropic hormone may help.

In those cases in which suppression of lactation is desirable, the intake of fluid should be reduced, saline aperients administered, and also oestrin or stilboestrol.

A Contribution to the Study of Human Fertility.

Detailed records of the sexual lives of two married couples are presented, the date of each individual act of coitus being correlated with the time in the menstrual cycle. Contraception was practised only during the fertile period of Knaus (10th to 15th days inclusive).

In the first case 126 acts of coitus during 33 consecutive monthly cycles took place without conception. At the end of this time, coitus was practised during the 5 days of the 6-day fertile period, and conception resulted.

In the second case 450 acts of coitus during 61 consecutive monthly cycles did not result in conception. Contraception was practised only during the fertile periods.

The data are presented in support of the views of Knaus and as a stimulus to others to keep such accurate records.

Transplacental Tuberculous Infection.

A semi-conscious woman, suffering from tuberculous meningitis, was admitted to hospital in labour. A living female child was born 4 hours later. The mother died on the 3rd day.

The child, although premature, made good progress until the 3rd month. Glandular enlargement was then noted, and after 2 weeks' illness the child died. Post-mortem examination revealed miliary tuberculosis of the lungs with glandular lesions throughout the body.

In this case there was no post-natal contact between mother and child, and evidence was absent of tuberculosis in other members of the family. It is suggested that infection took place via the placenta, although proof is lacking since the placenta was not examined microscopically.

T. N. A. JEFFCOATE.

---

## The Canadian Medical Association Journal

Vol. xliii, No. 4, October, 1940.

*Carcinoma of the cervix in the first three decades of life. N. D. Hall.

CARCINOMA OF THE CERVIX IN THE FIRST THREE DECADES OF LIFE.

A report on 134 cases of carcinoma is discussed, the cases occurring in the first three decades of life, and having been verified microscopically. An important point is the unexpected frequency of carcinoma occurring in young people. The largest proportion of these cases was carcinoma of the cervix. A review was also made of 57 cases of cancer of the cervix in patients of 30 years of age and under. This represents approximately 7.4 per cent of all cases of carcinoma of the cervix seen at this clinic. This contrasts with a report of cases from another centre, where the frequency of carcinoma of the cervix in the first three decades of life was found to be 4.9 per cent of all cases of epithelioma of the cervix. This latter report, because it does not include cases verified microscopically, does not include 26 cases of clinically positive carcinoma, 13 of which died within 14 months. Of the 57 patients all were married except one, 10 of them being negro women. Five had positive Wassermann tests. In 4 of these cases, carcinoma had occurred in the stump of the cervix left after supravaginal hysterectomy had been performed. Some of these patients had symptoms which may have been due to carcinoma of the cervix at the time they came for the subtotal operations. A table illustrating the number of pregnancies is given. Of the 57 patients, 9 (16 per cent) denied any pregnancy. This contrasts markedly with a report published by the State Institute for the Study of Malignant Disease, Buffalo, New York, in which 78 women of 30 years and under with cervical carcinoma were considered, and of these 77 had from 1 to 8 pregnancies. Forty-six out of the 57 had an average of 3 children each. The greatest incidence of patients was in women who had had 1, 2, 3, or 4 pregnancies; in women who had 5 or 6 pregnancies, there were only three cases in each group, and in women who had 7 or 8 children, only one woman in each group.

Considering all these points, the authors are of the opinion that multiple pregnancies do not appear to be great factors in producing carcinoma of the cervix.

Another table is presented giving the ages of the various patients

when the first child was born. Twenty-one of these 57 patients (37 per cent) had been pregnant, and 19 had had children before reaching the age of 20, while they were not as yet fully developed. Two patients had children before reaching the age of 13; one of these had 2 children. One had a baby and one miscarriage before the age of 14; three had babies before the age of 15; two before 16; two before 17; three before 18; two of these latter having 2 children and 2 abortions; two had children before the age of 19, one of these having 2 children and the other 4.

Another table is presented showing that 9 patients had carcinoma of the cervix before reaching the age of 25. The youngest was 20, having been married at 13 and giving birth to her first baby at 14. She had been bleeding for four months before coming to the clinic. The growth was a squamous-celled carcinoma, grade 3, far advanced.

Fifty-two of the cases had symptoms for six months, 44 per cent of all having had signs for four months or less. One patient was treated by a doctor for several months without being examined. Fifty-seven per cent of the patients gave the first sign as vaginal bleeding; 20 per cent noticed a blood-stained discharge; 15 per cent had, in addition to bleeding, lower back pain; 10 per cent had noticed bleeding on coitus, and 5 per cent only gave the first sign as pain and discharge, but no bleeding.

A table giving the pathological reports is included. Fifty-five out of the 57 cases had squamous-celled carcinoma, only two having adenocarcinoma. Only one patient was seen in the first grade, 13 were in the second, 19 in the third, and four in the fourth.

As regards results, 52 patients were treated at the author's clinic, 21 being alive and 31 dead. Of the patients who died, only one lived three years; 11 died under six months; seven between six and 12 months; 10 between one and two years, and two between two and three years. Of the patients living (21, or 40 per cent), one was alive after five years, one after four years, 3 after three years, five after six months, and six under six months.

At the clinic whence these statistics are taken, there has been a great increase of patients with carcinoma of the cervix admitted during the past five years, and of this increase the proportion of women of 30 years and younger is much higher than the proportion of older women, the proportion being 240 to 70, or about three and a half to one.

There are several points which the author stresses. Carcinoma of the cervix does not seem to be more frequent in women who have had many children than in those who have had one or more children, but it does seem to be more common when there are early pregnancies, and it is thought that this may be due to lacerations and infections of the cervix occurring at an early age. Abnormal bleeding in some form occurred in 95 per cent of cases and was the only symptom in approximately 50 per cent. The prognosis of carcinoma of the cervix in young women is extremely poor. Nearly 50 per cent died within two years; only 11.5 being alive after two years, and 28.7 per cent under two years.

Another factor pointed out is that these young women presented them-

selves for treatment rather late, and it appears that medical practitioners are not sufficiently aware that irregular bleeding at an early age may be due to carcinoma, nor had they acquainted themselves sufficiently intimately with such conditions as cervicitis, erosion, ulceration, leucoplakia, and such affections of the cervix, which should all be treated, as they must be regarded as precursors of cancer.

Several short but highly explanatory tables are included in the text and a very short bibliography is appended.

J. LYLE CAMERON.